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Los Angeles

The Political Economy of
Consumption-Driven Climate Pollution

A dissertation submitted in partial satisfaction
of the requirements for the degree
Doctor of Philosophy in Political Science

by

Bronwyn Lewis Friscia

2018

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ABSTRACT OF THE DISSERTATION

The Political Economy of Consumption-Driven Climate Pollution

by

Bronwyn Lewis Friscia

Doctor of Philosophy in Political Science
University of California, Los Angeles, 2018

Professor Michael L. Ross, Chair

This dissertation consists of three essays that explore the political consequences of confronting the role that developed-world consumption plays in driving climate pollution worldwide. Using underutilized data on the annual consumption of greenhouse gas emissions by country and two original randomized survey experiments, I show that the implications of pollution-as-consumption are consequential for political action to reduce climate change at the international, domestic, and individual levels.

The first essay challenges the notion that international climate agreements can effectively reduce emissions by getting countries to pledge to decrease their emissions production. Using historical data on the annual production and consumption of emissions by country, I show that as countries become wealthier, wealth tends to drive emissions pollution via consumption channels significantly more than via production channels. If these patterns persist, international efforts to curb emissions production will be undermined as long as consumption is left unchecked.

The second essay, co-authored with Robert Trager, explores whether highlighting the role of developed-world consumers in driving global emissions improves domestic support for costly climate policies. We conduct an original large-N survey experiment to show that framing an international climate agreement as a response to this pattern increases the agreement's perceived fairness among U.S. citizens. This has a far greater impact on agreement

approval than cost, particularly among Republicans. We also find approval is increased by bipartisan support and information on the future financial cost of uncontrolled climate change.

The final essay, co-authored with J.R. DeShazo and Tamara Sheldon, considers U.S. consumers themselves and the role that political identity plays in shaping willingness to pay for sustainable products. Using an innovative large-N experiment involving actual consumer purchases, we show that while liberal consumers are more willing to pay for an energy-efficient product when it is marketed as good for reducing climate change or saving money, conservative consumers can be induced to a similar willingness to pay for the same product when it is marketed as good for U.S. energy independence, a cause that better reflects conservative values. Our findings suggest that political identity shapes consumer behavior and can be leveraged to promote more sustainable consumption.

The dissertation of Bronwyn Lewis Friscia is approved.

James D DeNardo

George M De Shazo

Robert Trager

Michael L. Ross, Committee Chair

University of California, Los Angeles

2018

To my husband James,
who has lived, breathed, and encouraged me through every minute of this journey.

To my mother Barbara,
whose herculean efforts gave me every opportunity.

To my late father Bryan,
who believed deeply in education and would, I like to think, be proud.

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To paraphrase a beloved adage often attributed to one of my late father's favorite authors, Antoine de Saint-Exupery, it is said that if you want to build a great ship, you must not just leap into it by drumming up people to collect wood, cut planks, and divvy up the tasks. Instead, you must teach them to yearn for the endless immensity of the sea.

If this dissertation is my great ship { the greatest ship, at least, that I have built in my career to date { then I have built it because I was taught to yearn for the endless immensity of the sea that building it would train me to sail, and indeed to navigate with skill. This is the sea governed by the power of ideas and the rigor of scholarship, and I was taught to yearn for its endless immensity by the many mentors whom I have been fortunate to be guided by throughout this journey. I have them to thank for the gift of that yearning, and I would like to use this space to honor their role in this achievement.

I would like to thank first and foremost my chair, Michael Ross, for nurturing my academic development with care and acting as my North Star throughout this long endeavor. When I chose my dissertation topic in early 2015, Robert Keohane had just used the occasion of his James Madison Lecture to issue a call to action to young political scientists to do work that would grapple with and illuminate the global politics of climate change. When I expressed an interest in contributing to this research agenda, which I believed represented one of the frontiers of international relations scholarship in our discipline, Michael encouraged me warmly in this direction and agreed to chair my committee despite not having taught me since the first year of my doctoral training. He has been the best sort of champion to me in the years since then, ever supportive and always available to help me correct my course as I strove to make a meaningful contribution to a relatively new subliterature of political science.

I would also like extend my deepest thanks to Jim DeNardo, whom I have at times described as the godfather of my UCLA academic career for the tremendous positive influence he has had on my education since my very first quarter as a graduate student here. I met Jim as a student in his introductory statistics class, which functioned as the gateway to our

department's methods sequence for many years. That course was a transformative moment in my education: for the first time, I was taught statistics in a way that not only brilliantly illuminated the subject but also convinced me that strong methodological skills would be utterly vital to the work I wished to do as a political scientist. With Jim's encouragement, I completed our methods sequence as quickly as I could and applied to the UCLA Department of Statistics to complete its Master's degree, as well. When I was awarded that degree this past December, I had Jim to thank for it in no small terms. Jim was also instrumental in helping me conceptualize my dissertation topic in its earliest stages, always willing to mull ideas with me over a salad outside of Northern Lights or biscuits at John O'Groats over on Pico. When I expressed concern that mainstream political science had been slow to tackle climate politics, I still remember him telling me that the real challenge of working in this area would not be having no one to talk to, but rather the "embarrassment of riches" that I would encounter in fascinating and deeply important research topics. He was, as he so often is, absolutely right.

I want to warmly thank Rob Trager for his mentorship, as well. Rob was the first of my professors to invite me to co-author a paper with him, and the second of these collaborations appears in Chapter 3 of this volume. I can recall vividly the email exchange that produced the spark for this project: it took place on my 30th birthday in the summer of 2016, and it was a turning point that helped me hone the focus of the essays that comprise this dissertation. Rob had sent me his well wishes and asked how my dissertation was progressing; when I told him the subject of my first paper, Chapter 2 in this volume, he invited me to help him use the rest of an expiring grant to investigate whether talking about pollution responsibility in consumption terms could increase domestic approval of costly climate agreements. From there, our collaboration unfolded. Chapter 3 presents the version of this paper that we are currently preparing for submission to academic journals: Bronwyn Lewis Friscia and Robert Trager, "Fairness or Finance: Popular Support for Global Environmental Cooperation," Working Paper. Of the work that appears in Chapter 3, Rob has contributed the mediation analysis, the sections of the literature review focused on fairness, and a great deal of invaluable advice on how I could frame and improve the rest of the paper.

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considerable time at the UCLA Luskin Center for Innovation during my collaboration with J.R. over the last 18 months. When I was managing the logistics of getting our experiment underway under time pressure this spring, Constance did everything she could to ensure that UCLA Purchasing and our market research team at GfK agreed to contract terms in time. She also sourced the incentives to compensate our experiment participants, which saved me valuable time to focus on the other tasks needed to get our experiment into the field. I would like to thank Christian Zarate for lending his graphic design skills to creating the visual primes for our experiment, as well as Larry Osborn and Marlene Rosas at GfK for expediting our project. I am also grateful to the Bradley Foundation, the UCLA Graduate Mentorship Program, and the UCLA Dissertation Year Fellowship Program for providing the funding that supported my graduate training while I was preparing for and writing this dissertation. I am thankful for Clabe Hartley's hospitality at The Cow's End, the unassuming, irreverent, and deeply welcoming neighborhood coffee shop in Venice Beach at which so many of these pages have been written.

Finally, I owe the most of all to my husband James, my mother Barbara, and my late father Bryan, the three people to whom I have dedicated this dissertation. To Barbara and Bryan, I want to offer my deepest thanks for instilling in me a deep-seated belief in the power of education and in my own ability to move across the country to a city I did not know to pursue a very challenging and specialized kind of training. Having lost Bryan when I was almost too young to truly remember him, I know well that many parents would not have raised me to take such risks, much less support me in moving so far away to pursue them. To her eternal credit, my mother Barbara raised me as she and Bryan had planned: to travel widely, meet challenges rigorously, and never limit the scope of my ambitions or the vastness of my explorations, especially not in light of the losses that have happened to our family. Far to the contrary, she has encouraged me every step of the way, always reminding me to be kind to myself while retaining the will to finish what I start. Her special ability to acknowledge the challenges I have experienced during this long endeavor while always exuding confidence in my ability to overcome them have played an indispensable role in seeing me through the completion of this dissertation.

As for my husband, James has been my rock as I have worked to finish the hardest and longest intellectual project of my life, and his efforts to support me and support us during this time deserve a very special mention here. I met James in London in the spring of 2011, the week after I was accepted to UCLA for this PhD program, so our entire relationship would have been impossible had James not supported and believed in the importance of my doctoral research from the moment he met me. I can still remember where we were sitting on our first date when I told him my plans to accept the fellowship I had been offered, and I noted his admiration for and encouragement of my decision to follow this path. By the end of that summer, James had made plans to join me in moving eight time zones away, from London to Los Angeles, to carve out our first home together in Venice Beach while I worked to complete my graduate training, conceive this project, and write this dissertation. He has been not only my greatest and most steadfast cheerleader but also a shrewd strategic partner, always helping me to navigate completing this dissertation and pursuing my broader career goals in a way that balanced intellectual rigor with health, creativity, and joy. I cannot thank him enough for making these years of writing as happy as they were challenging, as well as for doing absolutely everything he could to help me to, at long last, see this day.

VITA

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CHAPTER 1

Dissertation Overview

"Consumption is the sole end and purpose of all production; and the interest of the producer ought to be attended to, only so far as it may be necessary for promoting that of the consumer."

{ Adam Smith, *The Wealth of Nations*
Book IV, Chapter VIII, v.ii, 660

1.1 Consumed Emissions and Climate Politics

The idea that the sole purpose of production is consumption { that we produce so that someone can consume { was revolutionary in 1776 when Smith's *The Wealth of Nations* was first published in Scotland. It was the age of mercantilism: the wealth of nations was thought to be measured in gold and silver, and British and European national economic policies largely aimed to maximize those stores of treasure by manipulating the balance of trade to favor exports over imports (Viner 1930, 255). Smith attacked mercantilism with the argument that a nation's true wealth lies not in the metal that sits idle in its capitalists' vaults, but instead in the home consumer's ability to afford the comforts that improve quality of life (Hirst 1904, 197-99). In mounting this critique, Smith set in motion a paradigm shift in both economic policy and economics: from mercantilism to the free market, and from understanding the purpose of production as lining elite pockets to understanding it as serving the sole end of popular consumption.

At the broadest level, this dissertation will argue that the politics of climate change { and, indeed, the work of political scientists to understand those politics { would benefit from a

similar paradigm shift. Since the adoption of the United Nations Framework Convention on Climate Change in 1992, the parties to the convention have met every year to negotiate the next step in the international community's coordinated policy response to climate change. During the era of the Kyoto Protocol from 1997 to 2012, climate negotiations focused largely on securing and enforcing legally binding commitments from developed countries to reduce their annual greenhouse gas emissions; in the years since then leading up to and immediately following 2016's landmark Paris agreement, the international effort has focused instead on securing pledges for intended annual emissions reductions from developed and developing countries alike. While these climate treaties have varied in design and scope, they have also shared at least two things in common. First, they have been largely ineffective at reducing global greenhouse gas emissions, which have continued to rise since 1992 (IPCC 2014).¹ Second, they have all measured a country's annual responsibility for emissions in the same way: in production terms, so that a country is considered responsible for the emissions produced within its borders in a given year (Aronis, Sakai, Scott et al. 2017).

This dissertation consists of three essays that explore the political consequences of measuring emissions responsibility in terms of consumption, not production. The consumption-based alternative to production-based emissions accounting is based on the Smithian observation that the production of emissions is always ultimately driven by consumer demand. Within this framework, a country's true emissions footprint is better represented not by the emissions produced annually within its borders, but by the emissions generated in the production, transportation, and final consumption of all goods and services consumed in that country in a given year, including those that are generated abroad in the manufacturing and shipping of imports (Wyckoff and Roop 1994; Kondoa, Moriguchia, and Shimizu 1998; Munksgaard and Pedersen 2001; Munksgaard, Wier, Lenzen et al. 2005; Peters 2008; Peters and Hertwich 2008; Davis and Caldeira 2010; Peters, Mix, Weber et al. 2011; Wiebe and

¹Scholars at the Global Carbon Project noted in 2016 that global emissions seemed to have peaked in the years directly leading up to the Paris agreement (Jackson, Canadell, Quere et al. 2016), but the International Energy Agency reported in March 2018 that the year immediately following the agreement had actually seen global emissions rise to record levels (IEA 2018).

Yamano 2016; Anon, Sakai, Scott et al. 2017).² Few political scientists have engaged with the notion of consumption-based emissions³, but it is a concept that this dissertation will argue has important implications for how we understand the optimal design of international climate treaties, the determinants of domestic public opinion regarding climate policy, and the potential for consumer-level interventions to promote sustainable consumption even in the absence of sweeping policy efforts.

1.2 Theoretical Motivations

A common theme runs throughout much of the work that political scientists and other scholars have done to illuminate why it is so difficult to mobilize collective action to confront climate change: it is costly to reduce greenhouse gas emissions, and it is difficult to get anyone to pay for it. This has been shown to be the case in research on international climate negotiations (Victor 2011; Keohane and Oppenheimer 2016), domestic public opinion of climate policies (Bechtel and Scheve 2013; Ansolabehere and Konisky 2014), and consumer demand for sustainable products (Peattie 2001; Bonini and Oppenheim 2008; Zabkar and Hosta 2013; Johnstone and Tan 2015). Put simply, it is an idea that has loomed large in how political scientists have understood the barriers to effective action on this issue.

At the international level, political scientists have noted that the costliness of reducing annual emissions production has made it advantageous for countries to free ride on the efforts of other states. Climate negotiations during the Kyoto era were plagued by what Victor called "global warming gridlock" for reasons he summarized succinctly in his book of the same name: "Few countries will adopt costly national policies aimed at solving global problems unless they are confident that their biggest economic competitors are enduring similar obligations" (Victor 2011, xxx). As Keohane and Oppenheimer have observed, accepting such costs "will be difficult for democratic publics and unpopular with authoritarian leaders striving to gain in wealth and power"; as a result, states will "seek when possible to shift

²Chapter 2 will contain a detailed explanation of how consumption-based emissions are estimated.

³Harrison (2015) is a noteworthy exception.

these costs onto others" (Keohane and Oppenheimer 2016, 145). The Paris agreement of 2016 ostensibly broke through those barriers with an appeal for all countries to choose their own intended contributions to global emissions reduction, but the price of near-universal adoption of the new treaty was what Keohane and Oppenheimer called "discretion and vagueness" in place of "mandates and simplicity" (Keohane and Oppenheimer 2016, 146). In other words, we should expect the same incentive structure to prevail, in which countries will tend to free ride on the costly efforts of others. As the introduction of Chapter 2 will note, the discretionary nature of the Paris agreement did little to prevent U.S. President Donald Trump from using the same basic argument for withdrawing the U.S. from the Paris deal that former U.S. President George W. Bush used to justify withdrawal from Kyoto: the agreement was too costly to the U.S. and not costly enough to its economic competitors.

Cost has also dominated the conclusions that have been drawn regarding the determinants of domestic support for global climate treaties and the roots of the apparent lukewarm consumer demand for sustainable products. In a study of the determinants of popular support for international climate deals, Bechtel and Scheve found that "[c]osts are the major drivers of support for global climate agreements" (Bechtel and Scheve 2013, 13764). Similarly, Ansolabehere and Konisky found that most of the U.S.-based respondents to their polling efforts for their 2014 book *Cheap and Clean* were "unwilling to spend more than a few dollars more on each month's electricity bill even 'if it solved global warming'" (Ansolabehere and Konisky 2014, 164). Research has also shown that it is difficult to convince individual consumers to pay a premium for sustainable products (Peattie 2001; Bonini and Oppenheim 2008). Indeed, some studies indicate that there are downsides to even marketing a sustainable product as such, a phenomenon that has been called the "sustainability liability" in the marketing literature (Luchs, Naylor, Irwin et al. 2010).

The three essays that comprise this dissertation present evidence that using consumption as a framework for measuring and addressing responsibility for climate pollution changes these dynamics in important ways at the international, domestic, and individual levels. The first essay will show that as countries grow richer, wealth tends to drive per capita climate pollution via consumption channels far more than via production channels, which creates

perverse incentives when it comes to complying with international climate treaties that measure emissions responsibility in production terms. Incorporating consumption-based emissions reduction targets into future global climate agreements could help restructure these incentives to be less gridlock-prone. The second essay will show that highlighting the role of developed-world consumption in driving global emissions increases the perceived fairness of even a costly climate policy among U.S. voters, and this is a far more powerful determinant of agreement approval than simple cost considerations. The third essay examines the determinants of consumer behavior itself, specifically the role that political identity plays in shaping willingness to pay for sustainable products. It will show that better understanding the interaction between consumers' political beliefs and how products are marketed to them can be leveraged to increase mass willingness to pay for sustainability. Taken together, these essays show that the implications of pollution-as-consumption are consequential for political action to reduce climate change at the international, domestic, and individual levels. The following section will describe these essays in greater detail and summarize their collective contribution to the literature on the politics of climate change.

1.3 Descriptions of the Essays

The first essay, which appears in Chapter 2, highlights and quantifies the problem that consumption-driven climate pollution poses for international agreements that attempt to reduce global emissions by regulating their production. The analysis focuses on a large and underutilized multinational panel data set released by the OECD on the annual production and consumption of emissions among major developed- and developing-world emitters during the Kyoto era from 1995 to 2011. I use this data to fit two linear panel models of annual production-based and consumption-based emissions per capita, respectively, as a function of a country's wealth and a slate of control variables that political scientists have historically linked to environmental performance. I use these results to predict a typical country's per capita production and consumption of emissions as it grows wealthier, revealing that increasing wealth tends to drive climate pollution through consumption far more than

through production. I argue that this finding has important implications for our theoretical understanding of the relationship between economic development and environmental performance, and it challenges the notion that international climate agreements can effectively reduce emissions by encouraging countries to decrease their emissions production. This is akin to regulating supply without also addressing demand, an asymmetry that creates perverse incentives for wealthier countries to appear to comply while making it difficult for their poorer trade partners to do so. In contrast, incorporating consumption-based emissions targets into international treaties could help realign incentives in a way that encourages greater compliance and better environmental outcomes.

The second essay, co-authored with Robert Trager, studies the determinants of domestic approval of international climate agreements, and one of its key hypotheses is that framing responsibility for emissions pollution in consumption terms will increase approval of even a costly agreement among U.S. voters. As noted above, not only have international climate negotiations faltered over how to share the cost of mitigating climate change, but cost has been highlighted as the primary determinant of domestic support for climate agreements in the political science literature. We report the results of a large-N randomized survey experiment conducted in July 2016 in which an international climate agreement was described and our respondents were asked if they would approve of U.S. participation in it. To explore the determinants of approval, several aspects of the survey were varied at random: the personal cost of the agreement to U.S. citizens, the partisan support the agreement received, and the information provided on current and historical responsibility for greenhouse gas emissions. We show that framing responsibility for climate pollution in consumption terms increases the perceived fairness of an agreement and has a far larger impact on approval than personal cost, especially among Republicans. We also find that bipartisan support and information on the estimated future costs of inaction on climate change have strong positive effects on approval. Taken together, this essay argues that the domestic aversion to cost found elsewhere in the literature is likely conditional on the perception that the agreement's costs to U.S. citizens are unfair, which framing pollution as consumption can evidently help overcome.

The third essay, co-authored with J.R. DeShazo and Tamara Sheldon, seeks to improve

our understanding of the political determinants of sustainable consumption itself. We hypothesize that political identity is essential to a complete understanding of consumer behavior, and the politicization of the sustainability cause as a "liberal" cause in U.S. politics has likely contributed to the lukewarm mass demand for sustainable products among American consumers. Using an innovative large-N experiment involving both stated preferences and actual consumer purchases, we show that while liberal consumers are more willing to pay for an energy-efficient product when it is marketed as good for reducing climate change or saving money, conservative consumers can be induced to a similar willingness to pay for the same product when it is marketed as good for U.S. energy independence, a cause that better reflects conservative values. Our findings suggest that political identity shapes consumer behavior and can be leveraged to promote more sustainable consumption on a mass scale. In addition to contributing to our theoretical understanding of the political psychology of consumption, this finding has an eminently practical implication: even in the absence of large-scale policy interventions, firms can employ these insights to increase mass willingness to pay for less emissions-intensive products.

As a collection, these essays fill an important gap in the political science literature because virtually all of the major findings in this area are predicated on the current, production-based method of measuring, communicating, and addressing emissions responsibility. This dissertation presents evidence that a production-to-consumption paradigm shift in how responsibility for emissions pollution is conceptualized would have profound implications for our theoretical understanding of the barriers to political action to mitigate climate change at the international, domestic, and individual levels. Using consumption as a framework for understanding pollution responsibility has the potential to restructure the incentives to comply with international climate agreements in a more productive way, increase domestic support for U.S. leadership on this issue, and motivate consumer-level interventions that increase mass willingness to pay for sustainable, emissions-reducing products. These insights are equally relevant to policymakers and activists, suggesting that a greater focus on the role of consumption in driving the production of greenhouse gas emissions could have a positive and dramatic impact on climate politics.

CHAPTER 2

The Problem of Consumption-Driven Emissions for International Climate Politics

\As someone who cares deeply about the environment, which I do, I cannot in good conscience support a deal that punishes the United States { which is what it does { the world's leader in environmental protection, while imposing no meaningful obligations on the world's leading polluters. [...] [T]he bottom line is that the Paris Accord is very unfair, at the highest level, to the United States."

{ U.S. President Donald Trump,
on leaving the Paris climate deal¹

2.1 Introduction

On June 1, 2017, President Donald Trump announced that he was withdrawing the U.S. from the landmark Paris climate agreement reached in late 2015, calling the accord *\a massive redistribution of United States wealth to other countries"* and citing plans to *\see if we can make a deal that's fair"* instead. The notion that the agreement was fundamentally unjust in asking too much of the United States relative to other countries figured prominently in the rationale he offered to explain the decision. In particular, President Trump sharply criticized China for being *\able to increase [their] emissions... for 13 [more] years"* under the agreement's terms and India for making *\its participation contingent on receiving bil-*

¹*\Statement by President Trump on the Paris Climate Accord," 1 June 2017.*

lions and billions and billions of dollars in foreign aid from developed countries."² President Trump's decision was the latest chapter in a long series of conflicts between world leaders over how to distribute the economic burden of reducing global greenhouse emissions between the developed and developing worlds. In fact, Trump's criticisms of the relative weight of the developed and developing countries' contributions closely echoed those offered by President George W. Bush when he ultimately decided against signing the Kyoto Protocol, the Paris agreement's 1997 predecessor. In a statement released on June 11, 2001, Bush called climate change "a challenge that requires a 100 percent effort" and noted that China and India were "top emitters" that were "entirely exempted" from the agreement.³

Persistent gridlock, to borrow Victor's term, between developed and developing world leaders over how to distribute the economic burden of reducing global greenhouse gas emissions has been a chronic and recurrent feature of international climate negotiations since the early 1990s (Victor 2011). Emissions reductions are costly, and states are not eager to incur these costs, often seeking to shift the burden to others and free ride on their efforts (Keohane and Oppenheimer 2016). Against this backdrop of intractability and in-fighting, annual global emissions have continued to rise despite all international efforts to coordinate mitigation (IPCC 2014). The leaders of the developing world continue point to the developed countries as the world's major polluters due to their long history of emissions production, and developed world leaders like President Trump and former President Bush point to the developing countries as the world's major polluters due to their currently skyrocketing emissions production as they industrialize.

Focusing solely on which countries have produced or are producing the greatest volume of greenhouse gas emissions, however, obscures the extent to which the production of emissions in the developing world is increasingly driven by consumer demand in the developed world (Peters 2008; Peters and Hertwich 2008; Davis and Caldeira 2010; Wiebe and Yamano 2016). Emissions production may be increasing rapidly in the emerging economies of the developing world and either peaking or declining in most advanced industrialized countries, but part of

²Ibid.

³"President Bush Discusses Global Climate Change," 11 June 2001.

this effect is driven by the dynamics of globalization and rising international trade, effectively "leaking" emissions from the developed to the developing worlds (Cole and Neumayer 2005; Peters, Mix, Weber et al. 2011). While it is the only form of responsibility for climate pollution recognized by international law, the production of emissions is not the only lens through which to define who today's major polluters are, and relatively few voices in political science have considered how reframing emissions responsibility in consumption terms could affect international climate policy and politics (Anon, Sakai, Scott et al. 2017; Harrison 2015). These treatments have remained largely qualitative, and they have stopped short of a convincing argument for how international relations on this issue would likely be altered by such a shift.

This essay seeks to make two contributions, one empirical and one theoretical. Empirically, I seek to characterize the problem that consumption-driven climate pollution poses for international agreements that attempt to control global emissions by regulating production but leaving consumption unchecked. I approach this issue by modeling, quantifying, and visualizing the relationship between economic development and both the production and consumption of greenhouse gas emissions per capita. I begin by estimating a panel model of emissions pollution using a large, underutilized multinational data set released in recent years by the OECD on the annual production and consumption of emissions by country for major developed and developing world emitters during the Kyoto era from 1995 to 2011. I then use this model to predict the emissions pollution levels that we should expect to observe as the typical, median country develops economically.

I show that as countries grow wealthier, wealth tends to drive the consumption of emissions per capita far more than production of emissions per capita. The production curve exhibits the sort of peaking and tapering trajectory predicted by the economics literature on the relationship between development and environmental degradation (Stern 2015), but the consumption curve shows evidence that it may continue to surge upwards monotonically, which at least one other study outside of political science has found evidence for as well (Mir and Storm 2016). This finding is a contribution to the empirical literature that has

debated how best to understand the relationship between various forms of pollution and economic development, including emissions pollution. In reality, income growth is dirtier than it appears: high levels of development are associated with high-consumption lifestyles that make developed countries responsible for far more emissions pollution than measures of production would suggest. This illuminates why diplomatic efforts focused primarily on reducing emissions production should not be expected to dramatically alter global emissions levels so long as developed world consumption patterns are left unacknowledged and unaddressed. This is an attempt to solve a market issue by stifling supply without also addressing demand.

In the discussion that follows, I will attempt to clarify our theoretical understanding of how reframing emissions responsibility in consumption terms could potentially address three perverse effects created by international law's sole focus on production-based responsibility in light of these dynamics. First, the production focus has enabled the developed world to appear to comply with climate agreements regulating production, thanks in large part to shifts in trade dynamics. This obscures the role its consumers play in not only driving global emissions but doing so through the production of emissions in developing world manufacturing centers, making it harder for those countries to comply with the very same climate agreements. Second, as referenced already with respect to two U.S. presidents, the production focus has empowered developed world leaders in making ostensibly compelling, fairness-based arguments for failing to exhibit international leadership on this issue because enough is not being asked of the "major emitters" of the developing world. Finally, the production focus has contributed to a structure of perverse incentives to free ride on the efforts of other states, in part because compliance with reducing production does not incentivize collaboration with any other specific accountability partners in the international realm. Reframing global emissions responsibility in consumption terms and incorporating consumption-based emissions targets into international treaties could help realign incentives in a way that encourages greater compliance and better environmental outcomes.

In the section that follows, I will briefly frame the empirical analysis with an overview of the scholarly debate regarding theories of the relationship between development and pollu-

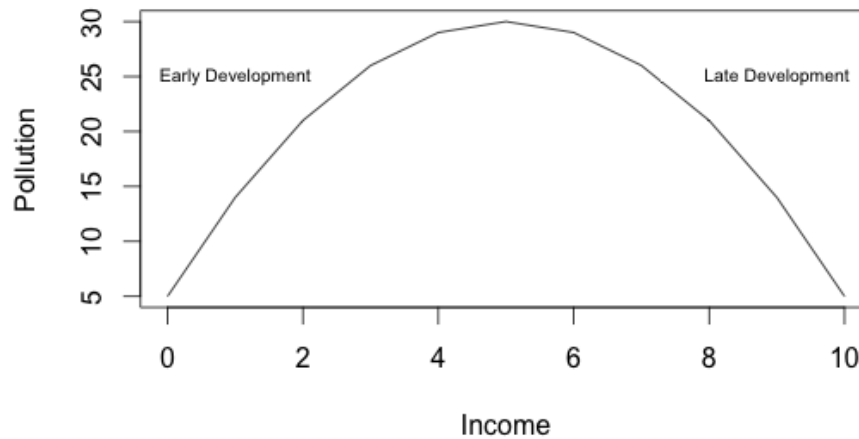
tion. I will then describe the data set I use in my analysis in more specific terms. Finally, I will present the results of the analysis and discuss their theoretical implications.

2.2 The Debate about Economic Development and Environmental Pollution

Political scientists and economists have devoted a great deal of energy to the question of how best to understand the relationship between economic development and environmental degradation. Perhaps the most prominent theory in this space is the environmental Kuznets curve (EKC) hypothesis, so called because it posits a similar upside-down U-shaped relationship between development and pollution to the one that the original Kuznets hypothesis of the 1950s proposed between development and economic inequality (Stern 2004). It was first proposed in Grossman and Krueger (1991), and it sparked a scholarly cottage industry debating its logic and empirical support during the 25 years that followed (Grossman and Krueger 1995; Torras and Boyce 1998; Suri and Chapman 1998; Dasgupta, Laplante, Wang et al. 2002; Perman and Stern 2003; Cole and Neumayer 2005; Stern 2015). Figure 2.1 illustrates the logic of theory: when environmental pollution is modeled as a function of economic development, low and high levels of development will be associated with low pollution levels, whereas intermediate stages of development will be associated with high pollution levels. In essence, pre-industrial countries are "too poor to be green," and post-industrial countries are affluent enough to take a serious interest in living in a clean environment.

At the time of its origin, the EKC theory offered an optimistic and counterintuitive argument against the prevailing wisdom that economic development is associated with monotonically increasing environmental degradation. Instead, the theory argued that as income rises, so too does pollution, but only to a point; eventually, rising income instead becomes associated with lower levels of degradation again. Andreoni and Levinson (2001) provide a good overview of the many causal mechanisms hypothesized to drive the late-stage decline, but they include higher popular demand for improvements in environmental quality, better resources to meet that demand, more international trade, and access to more efficient tech-

Figure 2.1: Stylized Logic of the Environmental Kuznets Curve

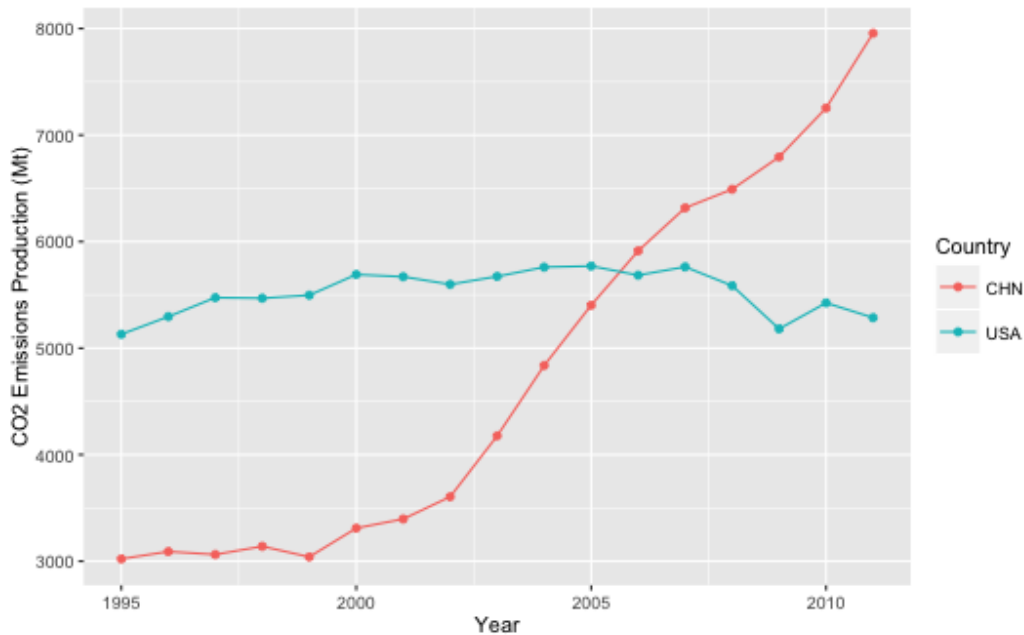


nology to abate pollution. Indeed, from the general perspective of the theory, it would be reasonable for international efforts to focus aggressively on securing commitments that will control the emissions production of top emitters: once most countries are "over the hump" of peak pollution levels during the modernization process, this model would predict that global emissions should eventually stabilize and simply begin to decline as modernization reigns.

25 years later, scholars continue to debate which forms of pollution appear to conform to the expectations of the EKC theory by declining at high levels of economic development. There is some consensus that the strongest empirical support for an EKC effect exists for the types of environmental degradation to which it was originally applied { mainly localized ambient concentrations of pollutants like sulfur emissions { while the relationship between economic development and less discernible, more diffuse pollutants like carbon emissions remains unclear (Stern 2015). Certainly, at first glance, the current pattern of emissions production in which the developed countries of the world are stabilizing or even declining while the developing countries are skyrocketing seems like a better fit for the EKC than the scholarly consensus would suggest. Figure 2.2 illustrates this point with a display of the vastly different trajectories in total emissions production between the U.S. and China during the Kyoto era from 1995-2011. This impression that the developed world is "on the

downswing" is often implied in the arguments made by developed world leaders like President Bush and President Trump as to why the developing world is not pulling its weight.

Figure 2.2: American vs. Chinese Emissions Production, 1995-2011



Since 1990, however, three interrelated trends have problematized the impression of the world given by Figure 2.2: the rise of global supply chains that increasingly locate manufacturing in the developing world, the explosion of international trade between the developed and developing worlds as globalization has marched forward, and the steady increase of annual greenhouse gas emissions despite all international efforts to coordinate mitigation efforts (Peters, Mix, Weber et al. 2011). The observation that these international trade dynamics have contributed substantially to this persistent upward trend in global emissions has led scholars in the ecology and earth systems fields to argue for greater emphasis on consumption-based accounting of country-level emissions responsibility (Davis and Caldeira 2010). While these ideas have not been rigorously engaged in political science, they have profound implications for how we understand responsibility for mitigation, the fairness issues at play in the political debates on this topic, and way that we conceptualize the barriers to effective international cooperation.

While the EKC theory has been debated regularly since it was first proposed, this basic logic that economic prosperity need not imply negative environmental outcomes has remained a mainstay of environmentalist and scholarly thought (Stern 2004). Researchers continue to explore the relationship between emissions and economic growth with reference to the EKC literature (Sheldon 2017), and a few studies have begun to explore to what extent new measures of pollution more in the spirit of consumption-based emissions, like that a country's "ecological footprint," conform to its expectations (Bagliani, Bravo, and Dalmazzone 2008; Acar and Asici 2017). My empirical analysis contributes to this ongoing literature by showing evidence that production-based emissions follow an EKC pattern while consumption-based emissions may not, but my broader concern is to ground those observations in their implications for our understanding of climate politics in political science.

2.3 Data: Production and Consumption

This study uses a relatively new and underutilized panel data set from the OECD on the annual production-based and consumption-based emissions per capita by country for major developed and developing world emitters from 1995-2011 (Wiebe and Yamano 2016). The principal empirical models are estimated on a balanced panel of 952 country-year observations of 56 countries. To my knowledge, these data has not yet been explored by political scientists, so it will be instructive to describe the data set in further detail. A thorough explanation of how consumption-based emissions are estimated appears in Appendix A and will be summarized below, but a brief non-technical explanation of the difference between the two methods of measuring emissions responsibility is useful to outline. Consider a coffee table that is manufactured in a Chinese factory but ultimately sold to an American consumer in California. Under the production-based method of accounting for emissions responsibility, the emissions generated while producing that table are "Chinese emissions," because they were emitted within Chinese borders. Under the consumption-based method, in contrast, those emission are considered "U.S. emissions," because the consumer demand that drove the production of and ultimately "consumed" those emissions was American.

The OECD estimates of consumption-based emissions are generated from two data sources: the International Energy Agency's estimates of fuel consumption 2014 data on fuel consumption and the OECD's 2015 Inter-Country Input-Output system. These data are used to calculate the emission-intensities of production for each industry in every country. Emission multipliers for final demand are then derived from combining these emission intensities with the Leontief inverse of the ICIO. The estimated total carbon emissions embodied in final demand (FD) by country is given by

$$FD = \text{colsum}(CC) + D; \quad (2.1)$$

where D is a $1 \times n$ vector capturing the emissions generated by direct use (e.g. driving cars) in the n countries in the data set and CC is a matrix of size $kn \times n$ in which k is the number of industries. CC thus has one column for each country and one row for each country-industry combination, and the cells define the estimated volume of emissions that the column country consumes from the row country-industry annually. FD is the sum of two $1 \times n$ vectors that captures the consumption-based emissions estimated for each of n countries in a given year. The CC matrix is given by

$$CC = \text{diag}(EF)(I - A)^{-1}Y; \quad (2.2)$$

Here, $\text{diag}(EF)$ is a $k \times n$ diagonalized matrix of the vector EF of emission factors (so a matrix in which the vector EF comprises the diagonal elements and all other cells are 0). $(I - A)^{-1}$ refers to the global Leontief inverse of the ICIO system mentioned above, a matrix of size $kn \times kn$ that is a standard term this form of multi-regional input-output (MRIO) analysis. Finally, Y denotes the $kn \times n$ global final demand matrix. (For further details, please refer to Appendix A.) To estimate for production-based emissions instead, D is the $1 \times n$ vector capturing the emissions generated by direct use like driving in each country which is distributed to the appropriate country-industry rows of CC .

In their original form, the data make it possible to plot country trajectories for both total or per capita production-based and consumption based emissions throughout the entire Kyoto era of international cooperation on climate change.⁴ These are fascinating to visualize and compare, and it is worth briefly characterizing the data's capabilities in this way before the empirical analysis. Figures 2.3 and 2.4 plot the country-level trends in total production-based and consumption-based national emissions inventories, respectively, across the full country-year coverage of the data (plus one dominant purple trajectory at the top of each plot for the entire OECD and one labeled ROW for "Rest of World" capturing all countries outside the data set).

A few observations are worth making here. First, the displays are very similar to the naked eye, suggesting that the really interesting variation will be observed in at the level per capita emissions rather than total emissions. There is also little temporal variation in either plot with the exception of China's surging yellow trajectories, which supercedes that of the magenta United States around 2005 for production and 2009 for consumption. Third, the United States and China are tremendous outliers relative to the other single-country trajectories, and the OECD as a unit so dominates global emissions that it distorts the scale of both plots. Finally, the purple Rest of World trajectory directly beneath the United States rises steadily and ominously.

As Figure 2.5 shows, there is far richer heterogeneity to be observed from plotting the trajectories of both production-based and consumption-based emissions alongside each other for each of the countries included in the data set. From this exercise, it becomes immediately apparent that one of the central distinctions in the data is between net exporters versus net importers of emissions: that is, those (mostly developing) countries that produce more emissions than they consume, and those (mostly developed) countries that consume more emissions than they produce (Wiebe and Yamano 2016).

⁴In addition to the thorough explanation of how these data are generated that appears in Wiebe and Yamano (2016), there is a very user-friendly explanation and several interesting visualizations and explorations available on the OECD website at <http://www.oecd.org/sti/ind/carbondioxideemissionsinternationaltrade.htm>.

Figure 2.3: Trends in production-based national emissions inventories, 1995-2011 (Gt CO₂)

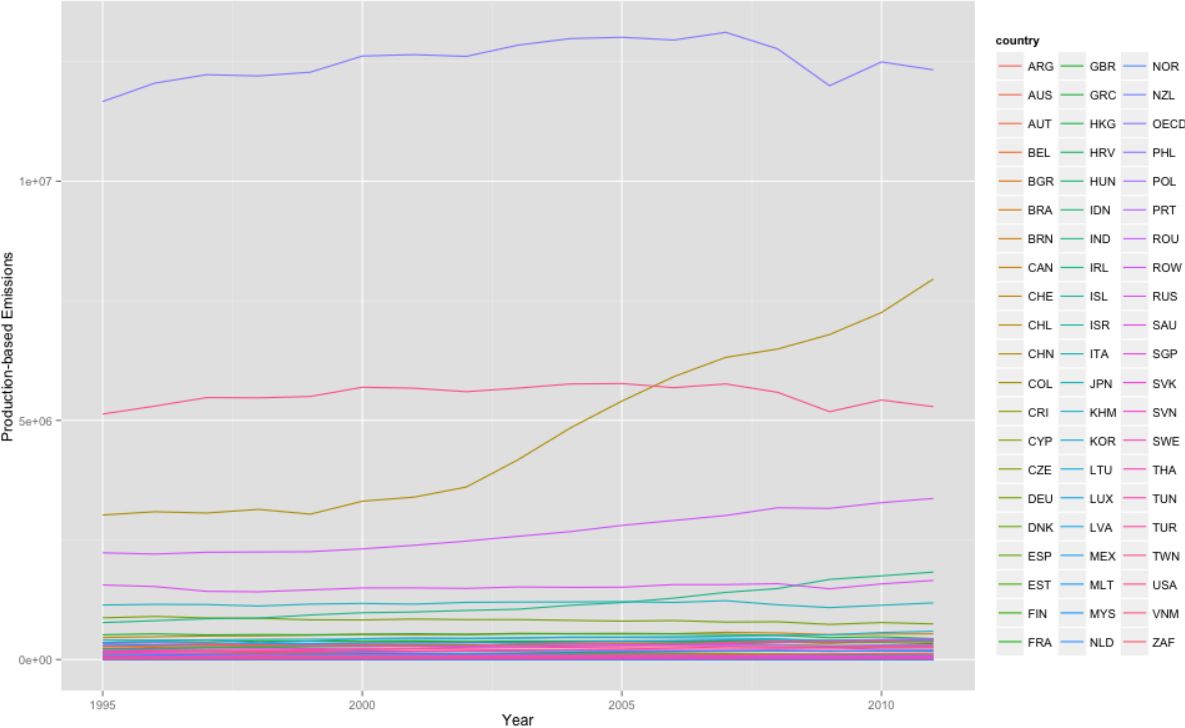


Figure 2.4: Trends in consumption-based national emissions inventories, 1995-2011 (Gt CO₂)

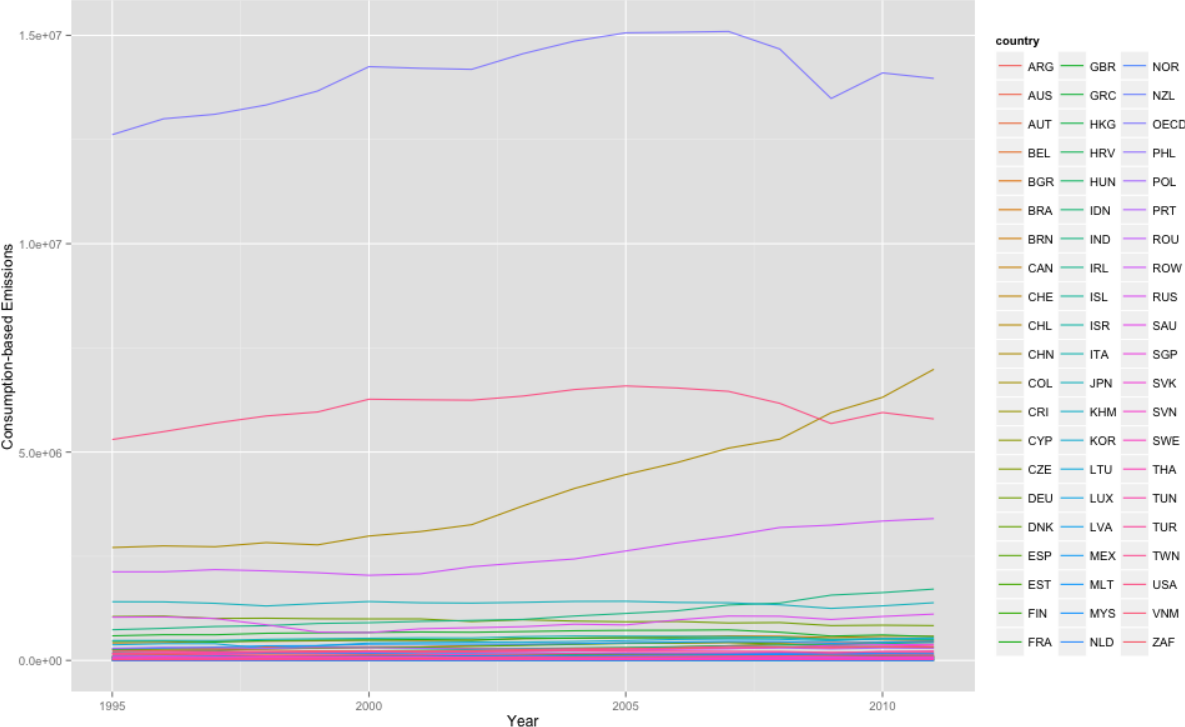
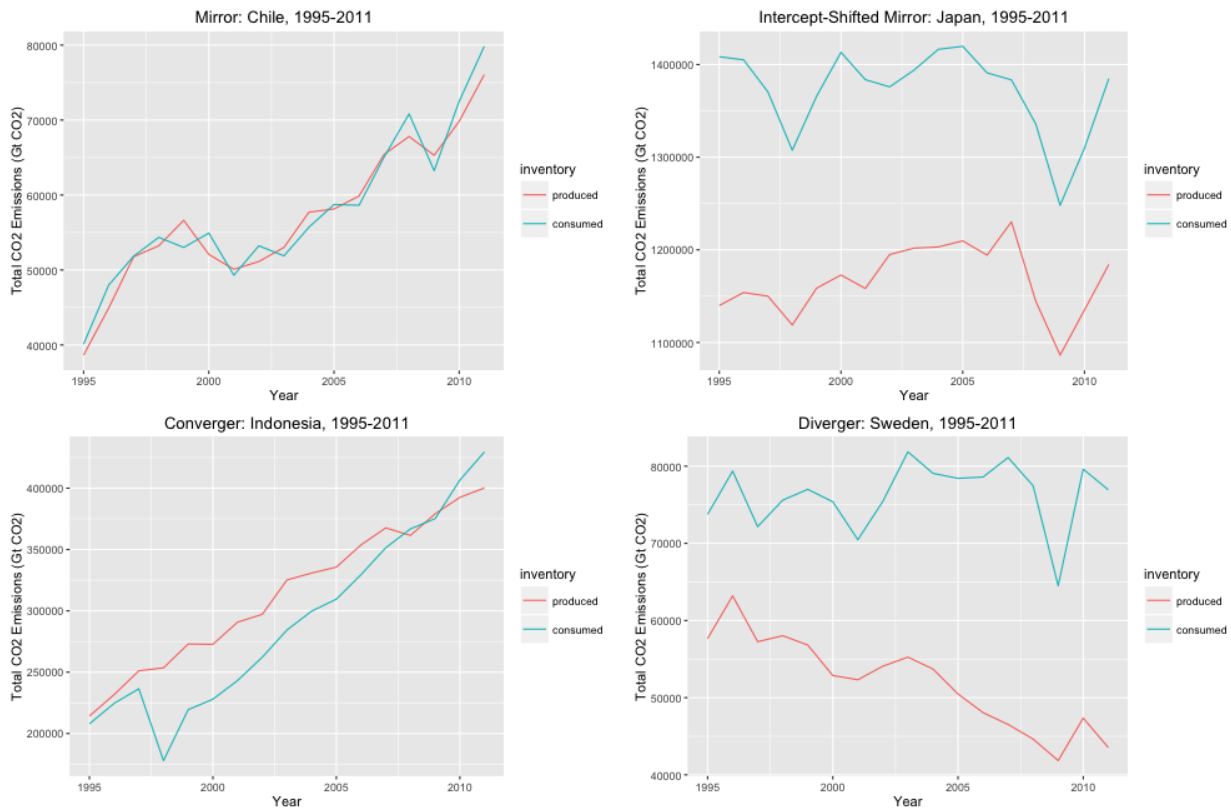


Figure 2.5: Broad Classes of Production- vs. Consumption-Based Emissions Trajectories



The national trajectories of the total volume of these two measures of emissions responsibility can be classified into one of several broad groups:

Convergers: Some countries in the data set, like Indonesia and Estonia, reveal trajectories that seem to converge over time (in both of these cases, as consumption of emissions rises to meet production of emissions).

Divergers: Other countries, like Norway and Sweden, have trajectories that have diverged over this same time period (in both of these cases, as production-based emissions have slowed, leveled, or declined while consumption-based emissions have grown or plateaued).

Mirrors: Some countries in the data set, like Vietnam and Chile, have seen production-based and consumption-based emissions levels that have marched in tandem to closely mirror each other, being almost exactly equivalent throughout this entire time period.

Intercept-shifted Mirrors: Other countries, like Saudi Arabia and Japan, exhibit trajectories that rise and fall almost in unison, but separated by an intercept shift of various magnitudes. Of these two in particular, it is worth noting that Saudi Arabia is a net exporter of emissions (meaning that it produces more emissions than it consumes across this whole period), while Japan is a net importer of emissions (meaning that it consumes more emissions than it produces across the same period).

Hybrids: Roughly a third of the data set is best categorized as exhibiting two or more of the four general trends above at different subsets of the time period covered by the data set.

Most broadly, this data set makes it possible to separate out and compare how much a country contributes to emissions waste via its own *regulated* economic activities of manufacturing, transportation, and industry versus how much a country's *people* contribute to environmental waste through largely *unregulated consumer demand*.

Using these two emissions series as outcome variables, these data could also be used to evaluate how any number of quantities of interest to political scientists affect national-level production versus consumption of emissions per capita. In other words, we know something about how political processes shape how much countries contribute to environmental waste through production, but how do political processes shape how much people contribute to environmental waste through their consumption habits? Do certain features of a country's politics shape which class of trajectories it exhibits? What shocks or developments precipitate changes in trajectory type? It would also be worthwhile to explore the power of net emissions as an explanatory variable. Can net emissions trajectories predict political positions assumed at international climate negotiations, or changes to political positions espoused? Can it predict greater participation in trade agreements, or a turn toward higher levels of political activism around environmentalism in a populace? There is much for political scientists to explore here beyond the empirical analysis I undertake in the following section, which I turn to now.

2.4 Model Specification

I estimate a series of panel models appropriate for the time-series cross sectional nature of the data set. There are four principal empirical models, which explain production-based and consumption-based emissions per capita (in kilograms) as a function of two different measures of my focal economic development variable, fixed effects for both country and year, and a set of time-varying control variables that the existing literature has suggested are also systematic predictors of emissions levels.

My outcome variables, *Production-based emissions per capita* and *Consumption-based emissions per capita*, are derived directly from the OECD data set described in the previous section. A square root transformation has been applied to both variables, which has the effect of making the distributions of both variables closely approximate a normal distribution. While these models make no assumptions about the specific distributions of their outcome (or predictor) variables, this transformation, along with the other variable transformations described below, produces the most homoskedastic and approximately normal residuals. As such, these transformations provide the greatest confidence that the models fit to this version of the data meet the assumptions of homoskedastic and normally-distributed errors.

Both measures of my focal predictor variables measuring economic development are taken from the Penn World Tables (Feenstra, Inklaar, and Timmer 2015).⁵ I include both GDP per capita and its square as required by the standard EKC model to provide for non-monotonicity in the relationship between development and emissions pollution per capita. *Real GDP per capita (Expenditure-based)* is a measure of real GDP per capita at chained PPPs in millions of 2005 USD, which is best suited to comparing relative living standards across countries and over time, and of the two I consider this my primary predictor. *Real GDP per capita (Output-based)* is a different measure of real GDP per capita at chained PPPs in millions of 2005 USD, which is best suited to comparing relative productive capacity across countries and over time. I include it to perform a robustness check on the results obtained using the expenditure-based measure. Theoretically, the distinction between the two measures

⁵The data is available for download at www.ggd.net/pwt.

also allows the study to test how the EKC relationship changes, if at all, when economic development is defined as personal living standards versus country-wide production capacity. A square root transformation is applied to these variables as well to roughly normalize their distributions. My principal empirical models also contain a battery of control variables, which are described in the following section. Table 2.1 provides a detailed summary of the variables that have been included in the core models, along with their data sources.

Democracy measures regime type on the numeric scale from -10 to 10 that the Polity IV Project database recommends for inclusion in quantitative time-series cross-sectional analysis.⁶ On this scale, -10 represents pure autocracy and 10 represents pure democracy.

GDP growth (Expenditure-based) and *(Output-based)* measure the annual percent change in GDP from the previous year to the current year as derived from the expenditure-based and output-based measures of GDP in the Penn World Tables database, respectively. Only one of these variables is included at a time: growth in expenditure-based real GDP is used when the focal variable measures expenditure-based real GDP per capita; growth in output-based real GDP is used when the focal variable measures output-based real GDP per capita.

Trade Openness measures a country's trade openness in a given year, calculated as the sum of imports and exports expressed as a percentage of GDP. The natural logarithm of this variable has been taken to normalize its highly right-tailed and skewed distribution. These data are obtained from the World Bank's World Development Indicators database.⁷

The panel models also include both country and year fixed effects and panel-corrected standard errors clustered by country, which accounts for the expected timewise heteroskedasticity and serial correlation in the time-series cross-sectional data used to estimate the models. I assume that the country fixed effects capture all time-invariant country-specific traits related to emissions pollution levels, and year fixed effects are included to control for exogenous shocks to emissions levels that may have impacted all countries in a given year, like the economic downturn associated with The Great Recession.

⁶The Polity IV Project Annual Time Series on Regime Authority Characteristics and Transitions (1800-2015) data can be downloaded at <http://www.systemicpeace.org/inscrdata.html>.

⁷This data can be downloaded at <http://data.worldbank.org/indicator/NE.TRD.GNFS.ZS>.

Table 2.1: Variables in the Core Empirical Models

Variable	De nition	Source
Production-based emissions per capita	Square root transformed measure of emissions per capita using production-based methods	OECD (2015)
Consumption-based emissions per capita	Square root transformed measure of emissions per capita using consumption-based methods	OECD (2015)
GDP per capita (Expenditure-based)	Square root transformed measure of real GDP per capita at chained PPPs in millions of 2005 USD, where GDP is measured using expenditure-based methods that best capture relative living standards	Penn World Tables (8.0)
GDP per capita ² (Expenditure-based)	Square of the income measure described immediately above	Penn World Tables (8.0)
GDP per capita (Output-based)	Square root transformed measure of real GDP per capita at chained PPPs in millions of 2005 USD, where GDP is measured using output-based methods that best capture relative productive capacity	Penn World Tables (8.0)
GDP per capita ² (Output-based)	Square of the income measure described immediately above	Penn World Tables (8.0)
Democracy	Index measuring political regime type on a numerical scale from -10 (pure autocracy) to 10 (pure democracy)	PolityIV Project (2015)
GDP Growth (Expenditure-based)	Annual percent change in GDP from the previous year to the current year, where GDP is calculated using expenditure-based methods	Penn World Tables (8.0)
GDP Growth (Output-based)	Annual percent change in GDP from the previous year to the current year, where GDP is calculated using output-based methods	Penn World Tables (8.0)
Trade Openness	Measure of a country's trade openness in a given year, calculated as the sum of imports and exports expressed as a percentage of GDP	World Bank

2.5 Results

The results from estimating these models are reported in Table 2.2 but best visualized in Figure 2.6, which displays the trajectories of the predicted values in the form of smoothed point estimates for both measures of emissions per capita at varying in-sample levels of GDP per capita while all other control variables and both types of fixed effects are held constant at their medians. It is apparent that the effect of increasing economic development on predicted emissions per capita looks very different for the production-based versus consumption-based measures.

The striking message of the plot is that, for the typical or "median" country, increasing economic development predicts significantly higher levels of consumption of emissions per capita than production of emissions per capita. Indeed, the estimated inflection point for consumption-based per capita pollution is 41.5% higher than the inflection point for production-based per capita pollution (20.206 kilograms per capita compared to 14.277) when expenditure-based GDP per capita is examined. Appendix B displays the same plot using output-based GDP per capita as the focal income variable instead; the results are robust to this alternative coding.⁸

The equivalent plot for the output-based measures of GDP is available in the appendix, and it is worth noting that the two plots are consistent in their predictions of what these effects look like and precisely where their inflection points take place. Regardless of how GDP per capita or emissions per capita is measured, the turning point at which economic development starts to reduce per capita emissions waste rather than increase it for the otherwise "median country" takes place at about \$45-50,000: the inflection points occur at about \$49,000 and \$53,000 for production- and consumption-based emissions per capita, respectively, when expenditure-based GDP per capita is used, and at \$39,000 and \$49,000 respectively when output-based GDP per capita is used.

Troublingly, this is a level of wealth that is all but unobserved among even the world's

⁸When output-based GDP per capita is used, the consumption-based inflection point is 38.9% higher than its production-based counterpart (19.848 kilograms per capita compared to 14.294).

Table 2.2: Results from Principal Empirical Models

	<i>Dependent variable:</i>			
	Production-based emissions per capita		Consumption-based emissions per capita	
	(1)	(2)	(3)	(4)
Real GDP per capita (Expenditure-based)	0.014 (0.004)		0.021 (0.004)	
Real GDP per capita ² (Expenditure-based)	0.00003 (0.00001)		0.00005 (0.00001)	
Real GDP per capita (Output-based)		0.016 (0.004)		0.023 (0.004)
Real GDP per capita ² (Output-based)		0.00004 (0.00001)		0.0001 (0.00001)
Regime type	0.006 (0.007)	0.006 (0.007)	0.004 (0.006)	0.005 (0.006)
Real GDP growth (Expenditure-based)	0.001 (0.001)		0.001 (0.001)	
Real GDP growth (Output-based)		0.002 (0.001)		0.002 (0.001)
Trade openness	0.063 (0.076)	0.050 (0.075)	0.152 (0.075)	0.161 (0.075)
Observations	952	952	952	952
Country & Year Fixed Effects?	Yes	Yes	Yes	Yes
R ²	0.127	0.137	0.228	0.227
Adjusted R ²	0.117	0.126	0.210	0.209
F Statistic (df = 5; 875)	25.496	27.767	51.678	51.518

Note: PCSEs in parentheses.

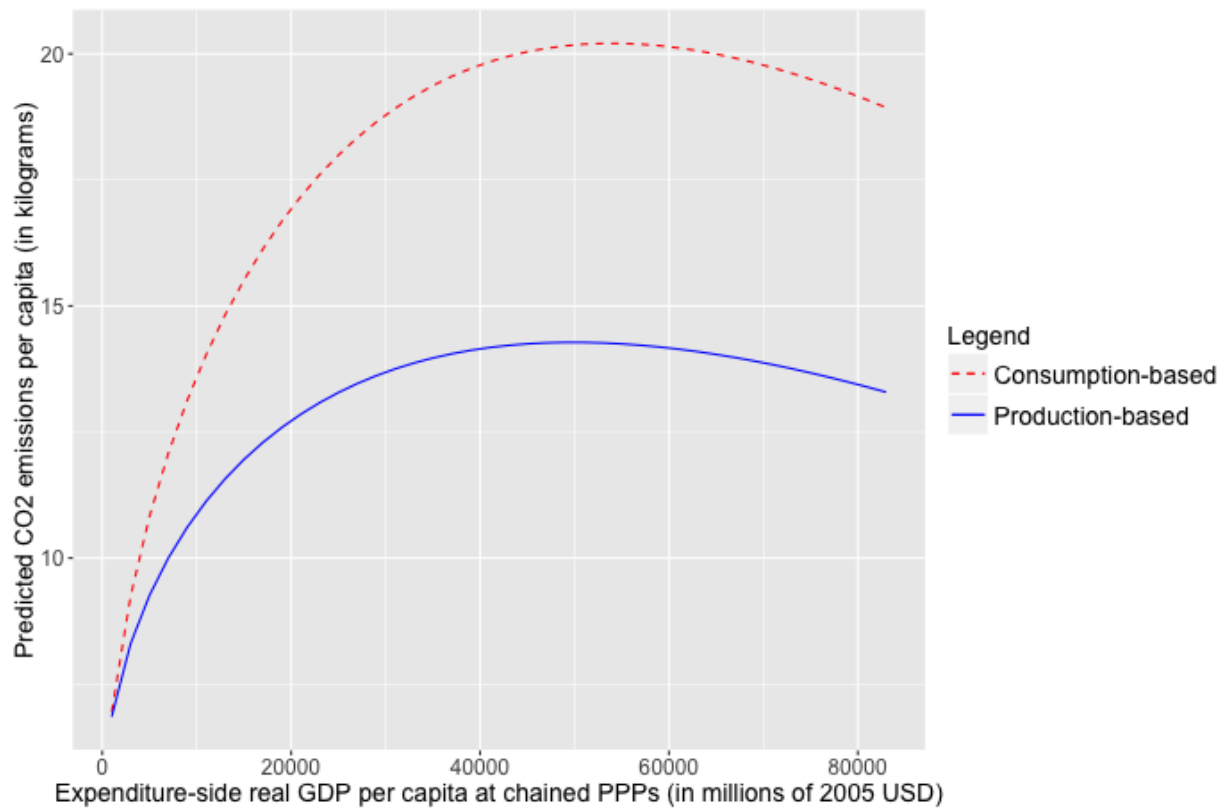
p<0.1; p<0.05; p<0.01

most advanced industrialized democracies for the years 1995-2011: only 25 out of 952 country-year observations for expenditure-based GDP per capita occur above \$50,000, and all of them come from either Luxembourg, Norway, or Singapore.⁹ By way of comparison, there are 212 observations in the \$30-50,000 range¹⁰, so it is important to note that these predicted inflection points are taking place at a per capita income level that is only observed in three countries that few would consider "typical." The estimated effect of GDP per capita on both measures of emissions is thus only well-supported by the data up until these in-

⁹The number is only 22 observations from the same three countries for output-based GDP per capita.

¹⁰There are 195 observations in this range for output-based GDP per capita.

Figure 2.6: Predicted Emissions per Capita as Expenditure-based GDP per Capita Varies



tion points, so it is unclear if the consumption-based curve for the "typical" country indeed begins to decrease after this point { or whether it continues to soar upward.¹¹

2.6 Discussion and Implications

These results indicate that as countries grow wealthier, wealth tends to drive emissions per capita via consumption channels significantly more than via production channels. Political scientists and economists have long debated which pollutants peak and decline with growing economic development as the EKC hypothesis predicts versus which appear to exhibit monotonic upward growth. Using new data spanning the modern history of attempted climate cooperation, my models of these two measures of emissions pollution predict that while production-based emissions tend to peak and taper with increasing wealth, consumption-

¹¹For an analysis that concludes the relationship is monotonically increasing for consumption-based emissions, see Mir and Storm 2016.

based emissions clearly peak at a much higher level of pollution and may actually continue to increase if our income data is too sparse after the inflection points to inform generalizable predictions. This forecast is problematic in light of the fact that all international climate treaties to date have measured emissions responsibility in production terms. It suggests that as countries economically develop, the growing global consumer demand that grows with them is likely to exert economic pressure at cross-purposes to the best political efforts at regulating production.

The focus in international law on measuring emissions responsibility in production terms has had at least three malign effects on the dynamics of international climate relations, and each of them could potentially be mitigated by a greater focus on the role of consumption in driving climate pollution. First, the focus on production has created incentives for the developed world to be content to *appear* to comply with treaties regulating production, obscuring the role its consumers play in not only driving global emissions but doing so in part through the production of emissions in developing world manufacturing centers, making it harder for industrializers to comply with the exact same treaties. This has decreased the informativeness of apparent compliance as a useful tool for gauging the success of a climate treaty, encouraged complacency among developed world leaders, and bred resentment and animosity among leaders of developing world. Dispelling with the illusion that the developed world has largely "complied with reducing emissions" could help reduce the tendency for latent conflicts between the developed and developing worlds to make cooperation on this issue harder than it already is.

Second, the focus on production has emboldened opportunistic developed world leaders in making ostensibly compelling, fairness-based excuses for abdicating leadership on this issue because not enough is being asked of the "major emitters" of the developing world. The role of the production focus in enabling these sorts of arguments likely contributes to distorting perceptions of fairness among domestic publics who are persuaded by the rhetoric of these elites. Indeed, Chapter 3 will present evidence to suggest that the unwillingness to support even costly U.S. international leadership on this issue may be *conditional* on the perception that paying those costs is unfair given the U.S.'s current level of responsibility for driving

emissions. Reframing climate pollution in consumption terms could decrease the power of these rhetorical strategies and likely have tangible positive effects on popular support for U.S. involvement in global climate policy.

Finally, the international focus on production has also helped create the perverse incentive structures that encourage free riding on the efforts of other states, and which Keohane and Oppenheimer (2016) has highlighted. This is in part because compliance with reducing emissions production is a one-country problem that does little to incentivize further collaboration with any other specific accountability partners after the global agreement is signed. Indeed, one of the central recommendations that senior political scientists have advocated for is for national leaders to shift focus away from amorphous global agreements and instead toward smaller, trade deal-style treaties or "climate clubs" that could offer more effective mechanisms for accountability (Victor 2011). Incorporating consumption-based emissions reduction targets into international climate agreements could encourage this explicitly by tying the fates of major trade partners and setting the collective expectation for emissions-reducing collaborative efforts to take place within already established trade partnerships. Consider the U.S.-China trade relationship, which as a unit generates significant consumption-driven emissions pollution. Whereas the production focus leaves these countries as economic competitors seeking both to appear to comply to targets while losing out as little as possible to one's rivals, a consumption focus would incentivize the U.S. and China to act as partners { accountable both to the world *and* to each other { to find ways to reduce the environment impact of their robust trade relationship. This has the potential to create incentives for collaboration that would not otherwise be encouraged explicitly by global climate policy, such as greater sharing of new, more sustainable technologies between developed and developing world trade partners (Anonis, Sakai, Scott et al. 2017).

The implications of the consumption perspective for political scientists are vast, and they reach beyond the potential changes to our understanding of climate politics that have been highlighted above. The consumption perspective offers a major alternative conceptualization of who "the polluters" are in any distribution principle in which "the polluter pays" in international climate agreements. The consumption alternative itself reveals that there is a

politics of emissions responsibility, and the production-oriented perspective that currently prevails in the international community serves the interests of the developed world at the expense of the developing world. The consumption perspective also highlights the extent to which our discipline has perhaps overlooked trade dynamics as an additional explanation for why international climate mitigation efforts have largely failed. Beyond chronic intransigence (Victor 2011), perverse structures of incentives (Keohane 2015; Keohane and Victor 2016), and a hobbling lack of real enforcement (Barrett 2003, 2008), there is also the fact that political borders are firm while economic borders are semi-porous. Regulations at home aimed at driving down production can be quietly offset by a whole population of developed world citizens exercising their consumer demand for largely foreign-manufactured, imported goods.

The practical insight of this paper is that, even if the Paris deal could get the majority of the world's countries to comply with dramatic reductions in their production-based emissions, we should not expect *global* emissions to improve so long as two conditions hold: a) countries continue to consume emissions at similar rates, and b) a manufacturing frontier exists in the developing world to meet much of that consumer demand. Future international climate agreements could likely help restructure the perverse incentives that currently characterize climate politics by popularizing the concept of consumption-based emissions and motivating countries to make targets to reduce the emissions they consume alongside those they produce. In doing so, such an agreement would acknowledge emissions as the negative externality of the globalized economic system that they are, by acknowledging and regulating the demand for emissions in addition to their supply.

2.7 Appendix

2.7.1 Appendix A: The Calculation of Consumption-Based Emissions

There are two distinct accounting procedures for estimating consumption-based national emissions inventories (Peters 2008).

The first accounting procedure goes by the acronym EEBT for "emissions embodied in bilateral trade," and it makes its estimates using monetary bilateral trade statistics. In Peters' language, this method "determines the emissions in one region r to produce the bilateral trade flow e^{rs} , and these are the emissions embodied in trade from region r to region s ." Importantly, this method "does not split the bilateral trade flow into components to intermediate and final consumption." As a result, this method does not take into account the global supply chain wherein third-party countries may produce components of a product that is ultimately exported from one country to another.

The second accounting procedure goes by the acronym MRIO for "multi-regional input-output", because it makes its estimates using the using multi-regional input-output tables associated with MRIOA (multi-regional input-output analysis). This type of economic analysis was pioneered by Wassily Leontief, who won a Nobel Prize in Economic Sciences for his MRIO model, and its key innovation is making it possible for the relationships throughout an economic system to be analyzed as a whole rather than in isolation. This method of emissions accounting does take into account the global supply chain in which third-party countries produce components of a product that are then imported to the country of production, assembled, and then sold as exports. The MRIO method has become the industry standard thanks to its higher level of detail. The OECD consumption-based emissions inventory estimates I use in this chapter use the MRIO method.

As noted in the text, the OECD estimates of consumption-based emissions are generated from two data sources: the International Energy Agency's estimates of fuel consumption 2014 data on fuel consumption and the OECD's 2015 Inter-Country Input-Output system. These data are used to calculate the emission-intensities of production for each industry in every country. Emission multipliers for final demand are then derived from combining these emission intensities with the Leontief inverse of the ICIO. The estimated total carbon emissions embodied in final demand (FD) by country is given by

$$FD = \text{colsum}(CC) + D; \tag{2.3}$$

where D is a $1 \times n$ vector capturing the emissions generated by direct use (e.g. driving cars) in the n countries in the data set and CC is a matrix of size $kn \times n$ in which k is the number of industries. CC thus has one column for each country and one row for each country-industry combination, and the cells define the estimated volume of emissions that the column country consumes from the row country-industry annually. FD is the sum of two $1 \times n$ vectors that captures the consumption-based emissions estimated for each of n countries in a given year. The CC matrix is given by

$$CC = \text{diag}(EF)(I - A)^{-1}Y \quad (2.4)$$

Here, $\text{diag}(EF)$ is a $k \times n$ diagonalized matrix of the vector EF of emission factors, so a matrix in which the vector EF comprises the diagonal elements and all other cells are 0, as shown:

$$\text{diag}(c) = \begin{matrix} & \begin{matrix} c_1 & 0 & 0 \\ 0 & c_2 & 0 \\ 0 & 0 & c_3 \end{matrix} & \end{matrix} :$$

$(I - A)^{-1}$ refers to the global Leontief inverse of the ICIO system mentioned above, a matrix of size $kn \times kn$ that is a standard term in this form of multi-regional input-output (MRIO) analysis. But what do its components signify?

Consider A . MRIO analysis is concerned with monetary flows between the different sectors of different countries, as formulated in Figure 2.7.¹² This formulation can be written more succinctly to imply as $x = Ax + y$, where x_r is a vector of total economic output of each sector in region r and y_{qr} is a vector of each sector's output produced in region q and consumed in region r (Davis and Caldeira 2010.).

¹²This image appears in "The Sustainability Practitioner's Guide to Input-Output Analysis," Murray and Wood eds., Common Ground Publishing, 2010.

Figure 2.7: Classical MRIOA Equation

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_m \end{pmatrix} = \begin{pmatrix} A_{11} & A_{12} & A_{13} & \dots & A_{1m} \\ A_{21} & A_{22} & A_{23} & \dots & A_{2m} \\ A_{31} & A_{32} & A_{33} & \dots & A_{3m} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ A_{m1} & A_{m2} & A_{m3} & \dots & A_{mm} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_m \end{pmatrix} + \begin{pmatrix} \sum_s y_{1r} \\ \sum_s y_{2r} \\ \sum_s y_{3r} \\ \vdots \\ \sum_s y_{mr} \end{pmatrix}.$$

To understand what A is, see Figure 2.8, which displays an example of an MRIO table for a world in which there were only three countries and three sectors/industries.¹³ As can be seen in the bold box, A is thus a block-matrix (meaning a matrix of matrices). Its dimension is $kn \times kn$, because there is a row and column for every sector within every country, with the country and industry of origin represented in the rows and the country and industry of destination represented in the columns.

Figure 2.8: An Example of MRIO Table (3 Countries, 3 Sectors/Industries)

Table 1: Example of a MRIO table

			Inter-industry Sales									Sales to Final Demand			Total Sales
			Country A			Country B			Country C			Country A	Country B	Country C	
			Agri	Manu	Serv	Agri	Manu	Serv	Agri	Manu	Serv				
Inter-industry Purchases	Country A	Agri	15	35	4	0	0.3	0.1	0	0.1	0.1	47	0.8	0.1	102.5
		Manu	24	400	45	0	5	0.7	0	7	3	215	9.8	15.6	725.1
		Serv	3	45	20	0	0	0	0	0	1	76.2	0	0	145.2
	Country B	Agri	0	0	0	3	22	4	0	0	0	0	14.1	0.1	43.2
		Manu	0.2	10	0.7	12	640	160	0.2	17	4	4.3	768	28	1644.4
		Serv	0	0	0	4	195	190	0	0	0	0	728	0	1117
	Country C	Agri	0.1	0.1	0	0.1	2	0.2	18	46	5	0.2	0.5	12	84.2
		Manu	0.2	5	0.5	0.1	10	2	21	930	330	3.3	13	1360	2675.1
		Serv	0	0	0	0	0.1	0	15	390	720	2	3	1873	3003.1
Value Added			60	230	75	24	770	760	30	1285	1940				
Total Purchases			102.5	725.1	145.2	43.2	1644.4	1117	84.2	2675.1	3003.1				

The block-matrix has 9 sub-matrices, one for each row-column pair of Country A, Country B, and Country C. In the shaded diagonal regions, we can see each Country's domestic trade among its own sectors, also known as a single-country IO table. In the 0-diagonal matrices, we can see the trade from each sector of the row country to each sector of the column country. Note that these elements are monetary flows in the MRIO table, and these are converted to emissions using the vector of emissions intensities by industry for each country.

¹³This image also appears in "The Sustainability Practitioner's Guide to Input-Output Analysis," Murray and Wood eds., Common Ground Publishing, 2010.

If that is A , what is I ? I simply denotes the identity matrix, so called because any matrix multiplied by I on either side retains its "identity" because it does not change: multiplying a matrix by I is like multiplying a (scalar) number by 1. In practice, I is any matrix in which the diagonal elements are all ones and the off-diagonal elements are all 0s, like below:

$$I_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

As a whole, the term $(I - A)^{-1}$ is known as the Leontief inverse. Recall that while matrix addition, subtraction, and multiplication all exist, there is no such matrix division. Matrix inversion, however, is a similar concept, because the inverse is the matrix equivalent of a reciprocal. Just as $\frac{1}{3} \cdot 3$ and $3 \cdot \frac{1}{3}$ both equal 1, so $A^{-1}A$ and AA^{-1} both equal I (the identity matrix, which is the matrix equivalent of the number 1 discussed immediately above). Finally, a matrix must be square to be invertible, so the Leontief inverse is like the matrix reciprocal of $I - A$, which is itself like the matrix equivalent of taking $\frac{1}{I - A}$. In practice, if A is of dimension $n \times n$, then I is a $n \times n$ matrix of the same size where the diagonal elements are 1's and the off-diagonal elements are 0's. Subtracting A means simply subtracting all corresponding elements (hence why matrices must be of the same dimension to be able to perform addition and subtraction on them). Taking the inverse of the result means finding the matrix that, when multiplied by $I - A$, returns the identity matrix.

Finally, Y denotes the $n \times n$ global demand matrix, where recall that n is the number of industries and n is the number of countries. This means that there is a row for every industry in every country and a column for every country, and each element represents the volume that the column country demands from the particular country's industry represented by that row. As a whole, then, this matrix captures how much every country in the world demands from every sector in every other country.

To understand what is meant by "global final demand," recall that the monetary flows in the MRIO table do not represent all world sales, but only inter-industry sales, so the money that is exchanged between sectors only. In contrast, this term is capturing the sales to final demand, so the sales made when a product made by a given sector in a given country (represented in the rows) is consumed in another country (represented in the columns). The inclusion of both the A and Y terms in this model is what enables it to take into account both intermediate and final consumption, attributing all emissions involved in producing a product to the country of final consumption.

2.7.2 Appendix B: Alternative Focal Variable Definition

Figure 2.9: Predicted Emissions per Capita as Output-based GDP per Capita Varies

Figure 2.9 displays a robustness check for the visualization in Figure 2.6, showing that the predicted emissions trajectories predictions are robust to an output-based alternative definition of the focal income variable. See Table 2.1 for a description.

CHAPTER 3

Fairness, Finance, and Domestic Support for Global Environmental Cooperation

\It will not be rhetoric as usual at Lima. We are going to talk about not only per-capita emission, but also per-capita consumption.

Former Indian Environment Minister Prakash Javadekar,
on fair climate mitigation burden-sharing

3.1 Introduction

Every year, the vast majority of the world's countries meet to negotiate next steps at the annual Conference of the Parties (COP) to the 1992 United Nations Framework Convention on Climate Change (UNFCCC). Every year, the sense of urgency at these negotiations grows, as the worldwide scientific consensus solidifies that the risks of unabated global warming will be devastating and substantial reductions in greenhouse gas (GHG) emissions are required immediately worldwide if the worst outcomes are to be averted. Every year, global emissions continue to grow despite these efforts at international cooperation (IPCC 2014). And every year for many years now, the same political cleavage has plagued the best diplomatic efforts at striking a deal that is both broadly acceptable and sufficiently powerful: a persistent disagreement between the developed and developing countries over how to fairly distribute the global financial burden of climate change mitigation and adaptation.

This point of disagreement has historically caused conflicts between developed and de-

¹Sophie Yeo, \India hints at new focus on consumption based emissions, Climate Change News 24 November 2014.

veloping countries during climate negotiations. For example, at the 2009 United Nations Climate Change Conference in Copenhagen (also known as COP15), Chinese Vice Foreign Minister He Yafei and U.S. climate negotiator Todd Stern clashed over Stern's position that the U.S. was not in the world's debt for its historical production of emissions and would not consider China a likely candidate for climate aid from the U.S. to help defray the costs of Chinese contributions to the mitigation and adaptation effort. At a press conference following these remarks, He called Stern "extremely irresponsible" and likened the U.S.'s expectations to asking China to pay a restaurant tab right after sitting down to the table. "Suppose there is a restaurant where the people from the developed countries have been eating for a long time," He said. "Just as the people from the developing countries sit down, the developed countries want them to share the restaurant bill. Is it really fair?"

The 2009 Copenhagen talks concluded with a promise of climate aid in the form of the Green Climate Fund, but the issue remained a political sticking point when the promised finance did not materialize. Four years later at COP19 in Warsaw, delegates from no fewer than 77 developing countries staged a symbolic walkout from the proceedings in protest of these missing funds. The New York Times reported that the talks were "bogging down over the old divide between rich and poor nations," with developing countries "in protest at what they consider inadequate financial support from wealthy countries."⁴

The question of climate finance continued to be salient in the most recent climate talks. In a statement ahead of the ministerial segment of COP21 in Paris in 2015, Indian Environment Minister Prakash Javadekar staked a place for India as a watchdog on this issue, saying that "India is here to ensure that rich countries pay back their debt for overdraft that they have drawn on the carbon space."⁵ While Javadekar ultimately praised and agreed to sign the

²Karl Ritter, "Chinese Official Calls U.S. Negotiator Irresponsible," U.S. News and World Report, 11 December 2009.

³Zhou Kai, "He Yafei cleverly asks the developed countries why we should pay the bill when we just sat down to eat," Beijing Evening News, 12 December 2009.

⁴David Jolly, "Developing Nations Stage Protest at Climate Talks," The New York Times, 20 November 2013.

⁵Amitabh Sinha, "Will ensure rich countries pay back: Prakash Javadekar" Indian Express, 7 December 2015.

voluntary pledge-and-review-based agreement adopted at Paris, he gave an interview only a few months later lamenting the ongoing disappointment of the Green Climate Fund. Far from the \$100 billion per year goal that the developed countries have repeatedly promised to mobilize by 2020, Javadekar noted that, "[t]oday only \$10 billion is available on the table. Even a country like America is promising only \$3 billion."⁶

The following year, the COP22 talks in Marrakesh were overshadowed by the election to the U.S. presidency of Donald J. Trump, who had promised on the campaign trail to pull the U.S. out of the Paris agreement if elected and made good on that promise on June 1, 2017. Prior to the exit, President Trump signed an executive order dismantling Obama-era measures like the Clean Power Plan that would have enabled the U.S. to meet its Paris commitments. The administration's justification for these moves again speaks to the question of fairness in how developed versus developing countries share responsibility for mitigation and adaptation. President Trump's appointment to head the Environmental Protection Agency, Scott Pruitt, has commented that the Paris agreement was a "bad deal" since China and India "got away scot free" by not pledging to hit any reduction milestones until 2030 while we in the U.S. "penalized ourselves through lost jobs."⁷ Such remarks have been popularly criticized for their departure from the Obama-era effort to communicate on the international stage that the U.S. intends to contribute significantly to the worldwide effort to confront climate change, but in many ways these comments represent simply more of the same logic that has historically caused persistent disagreements between developed and developing countries over how to share this burden.

Indeed, a familiar narrative was reported in the aftermath of late 2017's COP23 talks in Bonn, where U.S. State Department negotiators "angered a number of developing countries" when they "beat back proposals from poor countries that insisted that rich nations should offer a fuller accounting of the climate aid they are providing."⁸ This move was seen as

⁶Mayank Bhardwaj, "India calls on developed world to tax coal for climate fund," Reuters, 21 April 2016.

⁷Pilita Clark, "Trump's blow to Paris climate deal is not a knockout," Financial Times, 28 March 2017.

⁸Lisa Friedman and Brad Plumer, "What Happened (and Didn't) at the Bonn Climate Talks," The New York Times, 18 November 2017.

especially provocative in light of President Trump's statement that the U.S. would not be contributing further to the Green Climate Fund, which he announced in the same June 1, 2017 speech that withdrew the U.S. from the Paris agreement. Fiji was the official host of the Bonn talks, and its fellow island leaders expressed explicit disappointment in the consistent failure of wealthy countries to follow through on their climate aid commitments. While articulating his dismay, President Tommy Remengesau of Palau spoke of the need for the developed countries to make good on their promise of climate aid in terms of fairness: "This means life or death for us. It is a moral question, and it requires a moral answer."

This long-standing point of disagreement regarding burden sharing can be attributed to the two very different interpretations of the same fairness principle at work in the arguments of the developed and developing world leaders quoted here (Ringius, Torvanger, and Underdal, 2002). Ultimately, all sides agree with the "polluter pays" fairness principle that costs should be distributed according to responsibility for emissions, but they disagree about whether "the polluters" should be defined in historical or current terms. Are the real "polluters" the advanced industrial countries who historically created this problem, or the countries who currently contribute to perpetuating it as they now industrialize?

Recent work on the determinants of mass support for global climate agreements suggests that the "polluter pays" fairness principle is popular among the voters of the developed world, not just their elites. Both the historical and current interpretations of "polluter pays" cost-sharing tend to increase approval of an agreement relative to one in which only the rich countries foot the cost of mitigation and adaptation (Bechtel and Scheve, 2013). However, these positive effects are small compared to the negative effects of the cost of the agreement to households, a result that complements public opinion work on American sensitivity to cost when considering actions that could help the environment. In their 2014 book *Cheap and Clean*, for example, Ansolabehere and Konisky (2014, 164) write that "most Americans are ... unwilling to spend more than a few dollars more on each month's electricity bill even if it solved global warming." Yet, other studies suggest that the framing of the issue

⁹Ibid.

can increase individual support for even personally costly pro-climate action (Obradovich and Guenther, 2016; Albertson and Busby, 2015; Bain, Hornsey, Bongiorno et al., 2012), and there is evidence from other corners of the international relations literature that both elite cues and the moral framing of a policy are greater influences on individual support for foreign policies than simple costs.

This study is the first to examine the relative power of all three of these factors in determining popular support for a global climate agreement: its cost, its political context, and its framing of burden sharing responsibility through the "polluter pays" fairness principle. In particular, we explore the impact on popular approval of a third possible framing of who the "polluters" are: that of "polluters-as-consumers," which highlights how developed world consumption habits outpace those of the developing world in driving the production of emissions worldwide despite a vast disparity in population (Peters, Mix, Weber et al., 2011). We also consider the impact of the political party or parties endorsing the agreement on its popular support. We develop a series of hypotheses regarding these effects in the section that follows and then report the results of a large-scale survey experiment that we conducted to test them on a representative sample of the U.S. voting-age population.

We make several contributions. First, our results strongly challenge the existing finding that the personal financial cost of implementing an agreement is a central driver of popular support. However, we find that informing citizens of the future financial costs of allowing climate change to proceed unchecked increases approval substantially. Second, we find that bipartisan support significantly increases the popular approval of an international climate agreement, which we interpret as a sign that having both parties' support is viewed by voters as an elite cue regarding the agreement's general merit. Third, approval levels in the United States are strongly influenced by certain fairness primes about which countries are most responsible for climate change. Information about how the developed world's historical production of emissions created the global warming problem does not influence popular approval. In contrast, approval rises considerably when respondents are also provided with information about how much more the consumption habits in the developed world drive current global emissions compared to those in the developing world. Talking about responsibility for

emissions in consumption rather than production terms could play a role in more effectively building long-term popular support for American leadership in international climate policy.

3.2 Support for Costly Action on Climate Change: Economics or Politics

A substantial literature investigates what is fair in allocating the cross-national burdens of adjustment to ameliorate global warming.¹⁰ Much less scholarly energy has been devoted to understanding how fairness narratives and political contexts influence publics to favor or oppose global environmental agreements. In fact, the most significant study of the conditions under which democratic publics will bear adjustment costs finds that it is primarily the magnitude of these costs that influences Western publics (Bechtel and Scheve 2013). The most recent work in this area has continued to highlight the role of cost considerations in shaping public support for climate policy (Anderson, Bernauer, and Baietti 2017).

This finding is surprising because it does not hold in other areas of political life that involve sacrifice. Soldiers in battle risk their lives instead of fleeing in large part because of their attachments to those fighting alongside them (Kellett 1982). For publics, the nature of the cause, the justifications offered and the likelihood of victory are often at least as important as how many of the nation's soldiers are dying in determining popular approval. Thus, the percentage of Americans who approved of U.S. efforts in the Second World War reached 90% even after U.S. battle deaths were in the hundreds of thousands; the U.S. intervention in Somalia, by contrast, dipped down to 30% approval even though U.S. battle deaths never reached one hundred (Larson 1996). Although casualties are one factor in approval, they are interpreted in the light of others, and by themselves are not highly predictive of approval across conflicts (Gartner and Segura 1998; Eichenberg 2005; Gelpi, Feaver, and Reifer 2009; Hanania and Trager 2017).

¹⁰See Toth (1999) for a survey of work in this area.

¹¹Bechtel and Scheve (2013) find smaller magnitude effects associated with other factors including how the distribution of costs are allocated in an agreement.

In diverse areas of human social interaction, moral narratives influence willingness to sacrifice.¹² These narratives influence whether individuals are willing to accept jobs or forego income (Akerlof and Yellen 1988), buy products or do without them (Thaler 1985; Kahneman, Knetsch, and Thaler 1986), punish immoral actions in experimental contexts (Andreoni 1995), and participate in armed conflicts. Fairness concerns appear to restrict the bargaining space in the Arab-Israeli conflict (Goddard 2009) and fair agreements make peace settlements more durable following conflict (Druckman and Albin 2011; Albin and Druckman 2012)¹³ When leaders seek to motivate publics to take costly actions, therefore, they always use moral rhetoric; a moral justification was offered by the initiator of every interstate war of the past 200 years (Hathaway and Shapiro 2017).

Similarly, many studies demonstrate how the political contexts of proposals for international action influence approval. In the contemporary United States, the Republican reputation for hawkishness and the Democratic reputation for dovishness mean that swing voters show higher levels of approval for Democrats who go to war and for Republicans who remain out of conflicts (Trager and Vavreck 2011). By the same logic, it is easier for Republicans and those with more hawkish reputations to make peace (Schultz 2005).

This study examines the moral framings and political contexts of global climate agreements as determinants of willingness to sacrifice in the short term for environmental agreements that may offer long-term benefits. We evaluate the importance of these factors against agreement-cost factors. Thus, the first hypothesis that we test is drawn from Bechtel and Scheve (2013), the most significant study on the subject of popular approval of global climate accords to date. This study examines data from 8,500 respondents in 4 countries, including the United States. Because of the conjoint survey design in which participants were asked to evaluate one agreement against another, the *N* associated with the study is 68,000 agree-

¹²See Lind and Tyler (1988) for an overview of this literature and Krebs (2015) for a discussion of the role of moral narrative in international affairs.

¹³On the effects of fairness considerations in international relations, see also Kapstein (2006, 2008) and Franck (1995). For discussions of the effects of fairness in economics, see Thaler (1988); Camerer and Thaler (1995); Gauth, Schmittberger, and Schwarze (1982); Kahneman, Knetsch, and Thaler (1986); Gauth (1995); Oosterbeek, Sloof, and Kuilen (2004); Messick and Sentis (1979); Dawes and Thaler (1988); Rabin (1998).

ments, enabling highly precise inferences about effect sizes. The authors found that "costs are the major drivers of support for global climate agreements" (Bechtel and Scheve 2013, 13764). We therefore replicate the treatment from their study, which describes the cost of an agreement in terms of the size of the reduction in average monthly household income. We refer to this as the Household Income Cost Hypothesis

Household Income Cost Hypothesis Approval of a climate agreement is higher when the expected household costs are lower.

While this hypothesis is intuitive, and supported in one experimental context, we expected the effect of reasonable household costs to be moderate, relative to the effects of other determinants of approval. A primary reason for this expectation is that the magnitude of costs is not straightforwardly associated with approval of international action in other contexts as we noted above. A second reason we were dubious that household costs would have a large effect relates to the role of costs in a conjoint design of the sort analyzed by Bechtel and Scheve. In explicitly requiring respondents to compare one agreement to another, the design reveals the treatments to the survey participants. Informed respondents may be more comfortable basing their approval on a comparison of costs rather than on whether a plan is presented by a Democratic or a Republican president even though the latter may be a salient factor in a real-world context. We also suspected that the large effect of personal cost that Bechtel and Scheve found was in part driven by the small effects of the other treatments. The paper analyzes which of two agreements participants ranked higher; in the absence of other bases for selection, cost would drive the preference ordering of the two agreements without indicating the level of support for any agreement.

We next developed an alternative cost hypothesis. Just as the meaning of military action determines the human cost that societies are willing to bear, we hypothesize that the cost of action on climate change would be weighed against the costs of inaction. Surveys and survey experiments on this issue tend to present taking action on climate change as costly without also quantifying the cost of inaction { that is, the estimated financial cost to individuals of allowing climate change to proceed unchecked at current rates. Respondents were being

asked to choose between a certain loss or no loss rather than weigh a trade-off between a smaller loss now or a greater loss later¹⁴. We hypothesized that being told about both sides of this trade-off in this way, so that the cost of action could be directly evaluated against the cost of inaction, would have a substantial effect on approval. We refer to this as the Consequences of Inaction Cost Hypothesis

Consequences of Inaction Cost Hypothesis: Approval is higher when respondents can compare the costs of action to the costs of inaction.

We now turn to how the moral framing of the agreement influences approval. In particular, we evaluate whether information about responsibility for the creation of the global warming problem influences approval by influencing what respondents perceive to be fair. As we noted in the introduction, the argument that the historical responsibility for the problem lies in the developed world appears to be a highly salient political argument in the developing world. Would developed world citizens in the U.S. respond the same way? The issue involves some complicated moral questions because individuals today might believe they are not responsible for what was done in the same place in the past. Few white Americans support reparations for slavery, for instance (Brooks 1999; Cose 2005). As in that case, differing responses to the moral argument may drive strongly divergent preferences in the developing and developed worlds. We therefore examine whether information about the developed world's historical responsibility for the global warming crisis will increase approval of an agreement that involves costly concessions to developing world nations¹⁵. We call this the Historical Responsibility Hypothesis

Historical Responsibility Hypothesis: Information about the developed world's historical responsibility for the global warming crisis will increase approval of an agreement involving costly concessions to developing world nations.

¹⁴For related experiments, see Kahneman and Tversky (1979).

¹⁵Bechtel and Scheve (2013) investigate the effects of the agreement burden being born solely by wealthy countries or shared according to three other burden allocation standards. They find that publics in wealthier countries prefer that the developing world pay at least some part of the burden of adjustment although wealthier countries should pay more.

We next examine whether information about current responsibility for global emissions influences approval of an agreement. Previous research has suggested that agreements in which "the polluter pays" tend to be viewed as fairer than agreements in which the rich countries are expected to foot the bill (Bechtel and Scheve 2013). However, research from the ecology, earth systems, and climate policy fields on consumption-based emissions accounting has suggested that existing notions of how to understand who the "polluters" are should be reevaluated. Consumption-based emissions accounting refers to a system of assigning country-level responsibility for emissions not by within whose borders the emissions are produced but rather within whose borders the product being manufactured is ultimately consumed (Davis and Caldeira 2010). As an illustrative example, consider a chair that is manufactured in a Chinese factory and then exported to the United States and bought by an American customer living in California. The standard production-based accounting method would count the emissions produced while manufacturing the chair as "Chinese emissions," while the consumption-based method would count them as "U.S. emissions" since American consumer demand drove their creation.

While many developed countries have achieved reductions in their production-based emissions during and since the Kyoto era, proponents of consumption-based emissions accounting have shown that these countries have continued consuming emissions in high volumes, effectively driving demand for emissions production in the manufacturing centers of the developing world (Peters, Mix, Weber et al. 2011; Wiebe and Yamano 2016). This concept is often called carbon leakage, which refers to the phenomenon whereby environmental regulation in one country can reduce emissions at home but contribute to the creation of new emissions in other countries with laxer regulations (IPCC 2014). Countries systematically consume emissions at a far higher rate per capita than they produce them as they grow richer, which suggests that climate agreements focused on regulating production should not be expected to make large impacts on global emissions if consumption is left unchecked (Frischia 2018).

This issue has been largely ignored in international climate negotiations, with a few noteworthy exceptions.¹⁶ However, the potential of consumption framings for shifting how

¹⁶India's threat to push for a consumption perspective at the Paris climate negotiations is one such

voters view the fairness of an agreement in which "the polluter pays" are substantial and has never been estimated. On the contrary, descriptions of agreements in which "the polluter pays" typically place a strong burden on the manufacturing centers of the developing world as some of the world's greatest producers of emissions. If U.S. citizens have been shown to view these agreements as fairer, might they view an agreement that will be costly to the U.S. more favorably once they were informed of how much the consumer habits of developed countries like the U.S. drive the production of emissions in the developing world? We hypothesized that respondents would be more likely to support a costly agreement if they were informed of the developed world's current responsibility for global emissions via consumption channels, which we call the Current Responsibility Hypothesis

Current Responsibility Hypothesis: Information about the developed world's consumption-based responsibility for current global emissions will increase approval of an agreement involving costly concessions to developing world nations.

Finally, we investigate how the political context influences popular approval of a climate agreement. Following prominent political science literatures, we hypothesize that the signals sent by political elites will have substantial effects on popular preferences. When elites agree, approval is often higher across the political spectrum (Zaller 1992). Thus, we expect approval to be higher when Democrats and Republicans both support an agreement, which we call the Bipartisanship Hypothesis. Further, in line with the political proverb that "it takes a Nixon to go to China," we expect that an agreement will be more popular when it is championed by the side that is viewed as most skeptical of the benefits of an agreement. When a Republican president behaves "against type" by supporting an agreement, this should convey more information to voters than when a Democratic president takes the same action (Trager 2011; Saunders 2015). Thus, a Republican president may be able to achieve higher levels of support for the same agreement. We refer to this as the Against Type Hypothesis

exception. See, for example: Sophie Yeo, "India hints at new focus on consumption based emissions," *Climate Change News* 24 November 2014.

Bipartisanship Hypothesis: An agreement with bipartisan support will have higher approval levels.

Against Type Hypothesis: Approval will be higher when the agreement is championed by Republicans.

3.3 Experimental Design

To explore these hypotheses, we conducted a large-scale survey experiment on a representative sample of voting-age U.S. adults in July 2016. Following other studies of this kind (Tomz and Weeks 2013; Trager and Vavreck 2011), we executed the experiment online, employing the services of Survey Sampling International (SSI). Our sample size was 3,128 respondents, and an examination of the marginal distributions of the sample's sociodemographics reveals close comparability to recent data on the regional, racial, gender, educational, and political diversity of the U.S. population.¹⁸ Respondents were asked to read a vignette containing a proposal for an international climate agreement, consider some additional relevant information, and then answer questions about whether they would approve of U.S. participation in the agreement.

The design of the agreement described in the vignette, which can be viewed in Appendix B, had two central motivations. First, it reflects the real actions needed to keep global emissions in the "safe zone." We modeled the basic proposal after a recommendation made by climate scientists at Duke University (Kasibhatla and Chameides 2007) to accomplish this goal by having top developed- and developing-world emitters agree to begin regular yearly emissions reductions equal to 2% of their current annual production levels.¹⁹ Second, the

¹⁷93.16% of respondents answered the key question about approval of the agreement that bears on most of our core results, and 86.7% of respondents finished the full survey.

¹⁸See Appendix A for a summary of these distributions and how they compare to the U.S. population. Because we are interested in estimating treatment effects and not existing sentiments in the U.S. voting-age population, we do not apply weights to correct for the minimal imbalance present in the sample.

¹⁹We updated this recommendation to reflect the most recent data available on top emitters according to the World Resources Institute, as described in detail below.

agreement reflects last year's Paris climate deal not only in including both developed and developing countries but also in asking for significant financial support from the developed world to assist developing countries with mitigation and adaptation. We therefore included in the agreement a commitment for all developed countries to commit substantial financial contributions to a \$50 billion climate fund with this mission:²⁰

In these ways, the agreement was designed to provoke questions of fairness. Namely, respondents must evaluate if it is fair to ask rich countries to pay significant amounts to help poor countries mitigate and adapt to climate change while also asking them to achieve costly emissions reductions themselves. Given the popular sensitivity to cost that previous research on mass support for international climate agreements has suggested, we should expect this economically demanding aspect of an agreement to be unpopular at face value. This was intentional, designed to stack the deck against our treatments in order to provide a hard test for the effects of domestic political context and fairness primes on approval.

In addition to the vignette itself, respondents were also provided with a brief list of pieces of relevant information that they were told the participating countries were taking into account while negotiating the agreement.²¹ The content and order of these relevant pieces of information were randomized for each respondent, providing them with different information on the cost of the agreement, the party or parties that endorsed it, and the developed world's current and/or historical responsibility for climate change in consumption or production terms relative to the developing world. On the final pages of the survey, respondents were asked to answer a set of questions on whether they approved of U.S. participation in the agreement, how fair it was to the parties involved, and whether they believe the concerns about climate change are legitimate or overblown. Following other studies of this kind, we displayed the details of the agreement described in the vignette at

²⁰We chose \$50 billion because the Green Climate Fund seeks to raise \$100 billion annually from a combination of public and private developed-world sources by 2020, and for the purposes of our vignette we assumed that half of those funds would be asked of developed-world governments. For more information on the Green Climate Fund, readers can visit its website at <http://www.greenclimate.fund/about-gcf/global-context>.

²¹All of this information appeared on the page following the vignette except the political context treatment, which was embedded in the vignette itself.

the top of every page where respondents were asked to evaluate it in an effort to avoid the forgetting of key details (Tomz 2007; Trager and Vavreck 2011). This design allows us to make inferences about how public perception and approval of the agreement changed when respondents were exposed to different sets of relevant information.

Table 3.1 displays the experimental manipulations with the exact text seen by respondents who received each control or treatment condition. In the cost category, the control and first treatment conditions are taken from Bechtel and Scheve (2013), in order to be able to compare their estimates of the effect of an agreement's cost on approval to our own most directly. The control condition, which estimates that the agreement will cost the average U.S. household \$107 per month, reflects Bechtel and Scheve's estimate of a plan that would cost 1% of the annual U.S. GDP; the first treatment condition doubles this figure. These quantities were chosen by Bechtel and Scheve to match the Stern Report's estimate that keeping global emissions in the "safe zone" will cost industrialized countries a figure equal to about 2% of GDP per year. The cost estimates of inaction on climate change in the second treatment condition are taken from a study by Tufts climate scientists, which found that inaction would cost roughly 0.46% of U.S. GDP by the year 2050 and 3.61% of U.S. GDP by 2100 (Ackerman and Stanton 2008). We put this into cost per household terms²² so that it is comparable to other treatment conditions. The treatment tests the effect of adding this information about future costs of inaction to the higher personal cost of immediate action condition (\$213 per household per month) in order to create the hardest test for the effect of information about the costs of inaction.

In the Current Responsibility category of treatments shown in Table 3.1, the figures provided on the production and consumption of emissions reflect the divide between the developed and developing world in the 15 economies who are negotiating the agreement described in the vignette. These countries account collectively for about 80% of carbon

²²The Tufts report estimated that the equivalent of 3.61% of U.S. GDP in 2100 is roughly \$3.8 trillion in today's dollars. To estimate cost per household in 2100, we divided this figure by the number of households projected to exist in the U.S. in the year 2100 according to a 2000 U.S. census population projection for 1999-2100. This census report can be viewed online <http://www.census.gov/population/projections/files/natproj/summary/np-t1.pdf>.

Table 3.1: Randomly Assigned Conditions of the Survey Experiment

Category	Conditions
Cost	<p>(Control) It is estimated that the plan would reduce the monthly income of the average U.S. household by \$107.</p> <p>(1) It is estimated that the plan would reduce the monthly income of the average U.S. household by \$213.</p> <p>(2) It is estimated that the plan would reduce the monthly income of the average U.S. household by \$213. On the other hand, it is estimated that the cost of allowing climate change to proceed unchecked will itself reduce the monthly income of the average U.S. household by \$248 by 2050 and \$1,318 by 2100 .</p>
Political Context	<p>(Control) The Democratic U.S. president endorsed the proposal, but leaders of the Republican party in Congress were sharply critical of the proposed plan.</p> <p>(1) The Republican U.S. president endorsed the proposal, but leaders of the Democratic party in Congress were sharply critical of the proposed plan.</p> <p>(2) The Republican U.S. president endorsed the proposal, and leaders of the Democratic party in Congress were also supportive.</p>
Current Responsibility	<p>(Control) No information provided.</p> <p>(1) The developed countries produce carbon emissions that are 13% lower than what is produced in developing countries. In other words, the developing world contains many more people and produces more emissions.</p> <p>(2) The developed countries consume carbon emissions in energy and goods that are 13% higher than what is consumed in developing countries. In other words, the developing world contains many more people and still consumes fewer emissions.</p> <p>(3) The developed countries consume carbon emissions in energy and goods at a rate per person that is over 2.5 times greater than the rate in the developing countries. In other words, the average person in the developed world consumes far more emissions than the average person in the developing world.</p>
Historical Responsibility	<p>(Control) No information provided.</p> <p>(1) The total production of carbon emissions from 1850-present per person in the developed world is over 8 times greater than the total in the developing world. In other words, most of the climate change problem was created by emissions from the developed world.</p>

emissions worldwide. As noted in the vignette, these 15 economies²³ negotiating the agreement include all countries considered by the UN to be developed (UN, 2016) as well as the top six GHG emitters in the developing world according to the World Resources Institute.²⁴ To calculate the figures themselves, we use OECD data (Wiebe and Yamano 2016) on the annual country-level production and consumption of emissions.²⁵

In the first treatment condition in the Current Responsibility category, respondents were told that the developed countries produce carbon emissions that are 13% percent lower than what is produced in the developing countries," emphasizing the fact that the developing world contains many more people and produces more emissions. In the second treatment condition, respondents were given information in consumption terms instead. They were told that the developed countries consume carbon emissions in energy and good that are 13% higher than what is consumed in developing countries," emphasizing that the developing world contains many more people yet still consumes fewer emissions. In the third treatment condition, respondents were again given information in consumption terms, but this time at the per capita level. They were told that the developed countries consume carbon emissions at a rate per person that is over 2.5 times greater than the rate in the developing countries," emphasizing that the average person in the developed world consumes far more emissions than the average person in the developing world. In the control, respondents were given no information on the current distribution of responsibility for emissions in either production or consumption terms.

In the Historical Responsibility category of treatments shown in Table 1, the treatment

²³The agreement treats the pre-Brexit EU28 as one economy, so the nine developed economies in the agreement are Australia, Canada, EU28, Iceland, Japan, New Zealand, Norway, Switzerland, and the U.S.

²⁴These six developing-world emitters are China, India, Russian Federation, Indonesia, Brazil, and Mexico, according to Johannes Friedrich and Thomas Damassa's "The History of Carbon Dioxide Emissions," published on the World Resources Institute website on May 21, 2014 (available at <http://www.wri.org/blog/2014/05/history-carbon-dioxide-emissions>). The most recent data available from this source at the time of this study was for 2011, and we used the top GHG emitters rather than the top carbon emitters due to data availability in the OECD data set that we relied upon for our country-level estimates of production-based and consumption-based emissions.

²⁵This data set's documentation is cited above, and it is freely available online at <http://www.oecd.org/sti/ind/carbondioxideemissionsembodiedininternationaltrade.htm>. We use the most recent year in the data set, 2011, for the figures reported.

condition compares the cumulative volume of carbon emissions produced in the countries of the developed world from 1850 to the present divided by the total number of people currently living in those countries to the same figure for the rest of the countries of the world. Respondents were told that the "total production of carbon emissions from 1850-present per person in the developed world is over 8 times greater than the total in the developing world," emphasizing that most of the climate change problem was created by emissions from the developed world. In the control condition, no information about historical emissions was provided. The cumulative historical emissions data was calculated from the World Resource Institute's CAIT Historical Emissions tool (CAIT, 2014) and standard population figures for each country.²⁶

3.4 Results

3.4.1 Overall Treatment Effects

The results for the overall effects of each experimental condition on approval are summarized in Figure 3.1, which displays the percentage of respondents who received each experimental condition that subsequently expressed approval for U.S. participation in the proposed international climate agreement. The display shows the percentage of agreement approval associated with each control and treatment condition in the pooled data. The control for each category is always shown at the bottom of the plot for visual reference, and the darkened bars signify those treatment conditions with approval levels that were statistically distinguishable from those of their respective control conditions at a highly significant level ($p < .02$) in a two-sample difference in means t-test with Welch's adjustment for unequal variances. The error bars indicate the 95% confidence interval for each approval level as determined by a one-sample t-test.

²⁶The CAIT Climate Data Explorer's Historical Emissions tool provides access to data on cumulative carbon emissions from 1850-2012 by country (not accounting for land use change and forestry, which the OECD data used in the Current Responsibility category also excludes). Population figures for 2012 were used to match the most recent year in the cumulative calculation. CAIT's Historical Emissions tool can be accessed at <http://cait.wri.org/>.

Figure 3.1: Overall Treatment Effects in the Pooled Data

The results do not confirm the finding from previous studies that cost is a major determinant of popular support for global climate agreements. We find no support for the Household Income Cost Hypothesis that respondents would show greater approval when told the agreement costs less; respondents were equally likely to support U.S. involvement in the agreement when told that it will cost their households the Stern Report's estimate of \$213 per month or just half that amount. Consistent with the expectations of Consequences of Inaction Cost Hypothesis however, approval levels were 6 percentage points higher relative to the control (rising from 55.4% approval to 61.1%) when respondents were told both the higher personal cost of action and the projected cost of inaction on climate change (p < .02).²⁷ This is a stark departure from the conventional wisdom that Americans largely can-

²⁷The two approval levels are distinguishable at an $\alpha = .02$ error level in a two-sample difference in means t-test with Welch's adjustment for unequal variances. All parenthetical references to the significance level at which two approval rates are statistically distinguishable from one another are with reference to this difference in means test unless otherwise noted.

not be convinced to pay for costly action on climate change and will strongly discount the importance of preventing the incursion of future costs.

We found evidence that the domestic political context of a costly climate agreement does have an effect on approval, although not entirely as expected. First, the expectations of our Against Type Hypothesis that respondents would be more likely to approve if told that the president endorsing the agreement were a Republican were not borne out; approval levels were similar among respondents who were told that the supporting president was Democratic and those who were told the supporting president was Republican. We therefore found no evidence of the "it takes a Nixon to go to China" phenomenon in which hardliners are more trusted with uncharacteristic foreign policy decisions at work here at least if the Democratic Party opposes the Republican president.²⁸ However, approval was 6 percentage points higher relative to the control condition among respondents who were told that the agreement had bipartisan support, rising from 55.7% approval to 61.5% ($p < .01$), as the Bipartisanship Hypothesis predicts.

We also found evidence that fairness primes about "who pollutes" can have an effect on approval of U.S. participation in a costly climate agreement. Consistent with the expectations in the Current Responsibility Hypothesis approval was higher among respondents who were given information on how consumption habits in the developed world contribute more to current global emissions than the consumption habits of the major emitters of the developing world, despite the vast disparity in population between these two groups of countries. However, we do not find that the distinction between presenting this information in collective (i.e. aggregate) or individual (i.e. per capita) terms makes an appreciable difference in the size of the bump in approval. Relative to approval under the control condition, approval was 7 percentage points higher among respondents who received the information in aggregate terms (rising from 53.5% approval to 60.5% $p < .01$) and 6 percentage points higher among those who received it in per capita terms (rising from 53.5% to 59.3% $p < .03$). While

²⁸As we discuss below, there is some evidence of an interaction effect of the Political Context and Current Responsibility treatments. Even taking this into account in a variety of ways, however, the Against Type Hypothesis does not receive statistically significant support.

both of these approval levels can be distinguished from the approval level under the control condition, the difference between these two approval levels is not statistically significant.

The strength of the overall treatment effects for the two consumption-based fairness primes is noteworthy in light of the fact that we found no evidence of any treatment effect at all for the fairness prime containing information on the historical production of emissions. The approval level among respondents who received information about how the climate change problem was created by emissions from the developed world from 1850 to present was statistically indistinguishable from the approval level among respondents given no such information. These results do not confirm the expectation from the Historical Responsibility Hypothesis

One of our most intriguing findings concerns which combination of fairness-related treatment conditions had the strongest effect on approval. Relative to approval among respondents who received the control condition in both the Current Responsibility and the Historical Responsibility categories, approval was the highest among those respondents who received both a fairness prime regarding the current consumption of emissions in the developed world and a second fairness prime regarding the historical production of emissions in the developed world. Consistent with the overall treatment effects found for the current responsibility experimental conditions, the magnitude of the bump in approval was similar regardless of which of the two consumption-based fairness primes was paired with the history prime, so we combine these sub-groups for the remainder of this analysis. The bump was substantial: relative to approval under the control condition in which no current or historical responsibility prime was received, approval was 8.6 percentage points higher among respondents who received both the history prime and one of the consumption primes, rising from 53.09% approval to 61.69%. This approval rate under the condition combining the current consumption and historical production primes is distinguishable from the approval rate under the control condition ($p < .007$).

3.4.2 Mediation Analysis and the Role of Fairness

Overall, then, we found three important effects: discussing the costs of action alongside of the costs of inaction, a bipartisan political context, and framing responsibility in terms of current consumption. We examine the mechanism of each effect through analysis of five mediators. The first three of these relate to the fairness of the agreement. Respondents were asked whether the burden born under the agreement was fair to the U.S., to the developed world, and to the developing world. We expected that all of the treatments would influence these mediators and particularly the perception of whether the agreement was fair to the United States, as we discussed above. Nevertheless, we asked about the fairness to one's own nation, to the group of nations of which the respondent's nation is a part, and to the countries to whom the proposed transfer of resources would be made. We asked the three separate questions because research shows that individuals vary considerably on whether they show concern for self, group, and other (e.g. Graham, Haidt, and Nosek 2009; McDermott 2004; Rathbun, Kertzer, Reifer et al. 2016). The next two mediators relate to respondents' views about the importance of the global warming issue and the affordability of the agreement. Respondents were asked whether concerns about global warming are overblown and whether an agreement represents too great of a financial burden. These represent other plausible logics through which the treatment effects on approval could operate. For instance, one might expect the bipartisan treatment to influence whether partisan respondents' views on the importance of addressing global warming at all. Information about the costs of inaction might influence perceptions of whether the financial costs were worth paying. As we expected, each of these mediators is highly predictive of approval of the agreement in multivariate regressions with demographic controls (see Table 2).

Figure 3.2 illustrates the effects of these three treatments for which we found strong effects on the five mediators. Bipartisanship, a consumption-based framing, and information on the costs of inaction all show a statistically significant effect on respondents' perception of the fairness of the US burden in the agreement. The effects of the other two fairness mediators are mixed. We found little effect of the treatments on perceptions that the global warming

problem is overblown or on whether the agreement would be aordable. The exception is information on the costs of inaction, which causes respondents to be more likely to view the costs as a price worth paying.

Table 3.2 shows the effects of the mediators on approval of the agreement. Once again, the fairness mediators play the largest role. A shift in those three mediators alone from "Disagree" to "Agree" predicts a highly significant change in approval from "Somewhat Disapprove" to "Somewhat Approve" ($p < .001$). The other two mediators are also highly significant predictors, even controlling for the effects of party ID on a seven point scale and other demographic factors, though their effects on approval are somewhat smaller.

Table 3.2: Mediator Effects on Levels of Approval of the Agreement

We can use the analyses from Figure 3.2 and Table 3.2 to get a sense of the relative importance of the mediators in explaining the three treatment effects²⁹ As expected, the

²⁹We employ the standard approach to analysis of mediators, which is mathematically equivalent to the

Figure 3.2: Effects of Treatments on Mediators

fairness of the US burden in the agreement plays a large role, explaining about a third of each treatment effect by itself. This is the only mediator that plays a statistically significant role in the effect of the consumption treatment. The three fairness mediators together account for about half of the total effects of bipartisanship and information on the costs of inaction. Finally, about 3% of the effect of information on the costs of inaction is explained through the financial burden mediator. Thus, the mediation analysis further confirms the importance of fairness considerations as drivers of popular approval of a climate agreement.

3.4.3 Treatment Effects by Political Party

When we examine how these treatment effects vary by partisan sub-group, we observe several findings worth noting that are summarized in Table 3.3. Perhaps counterintuitively, we find no evidence that any of the primes in the current and historical responsibility experimental conditions had any effect whatsoever on approval of U.S. participation in the agreement among respondents who identify as Democrats³⁰. That said, approval was already extremely high within this sub-group, with approval levels ranging from a low of 68.73% among respondents who received the current responsibility prime in production terms to just over 71% among those who received either the control condition or one of the primes in consumption terms. We interpret this result as an indication that this sub-group is likely already supportive of U.S. leadership in global environmental policy for perhaps the very reasons suggested by the consumption-based primes, which would render it unsurprising that this information did not further raise approval levels.

In stark contrast, however, we find strong evidence that the consumption-based primes had a substantial and statistically significant effect on approval among Republicans³¹. Approval in this group was a staggering 9.86 percentage points higher relative to the control

approach recommended in Imai, Keele, and Tingley (2010) for linear models, such as those employed here.

³⁰We define Democrats as respondents who said that they either "lean Democratic" or are "moderate" or "strong" Democrats.

³¹We define Republicans as respondents who said that they either "lean Republican" or are "moderate" or "strong" Republicans.

Table 3.3: Levels of Approval by Party with Current Responsibility Fairness Primes

Condition	Democrats N=1,196		Independents N=806		Republicans N=912	
	Approval	Net	Approval	Net	Approval	Net
Control	71.79		45.25		38.39	
Production	68.73	3:06	54.82	9.57	40.82	2.43
Consumption	71.27	0:52	55.41	10.16**	48.25	9.86**

** Indicates that the net difference in approval between the treatment and control conditions is highly significant ($p < .02$) in a two-sample difference in means t-test with Welch's adjustment for unequal variances. The "Approval" column is the percent of respondents in that party sub-group who approved of the proposed agreement after receiving that row's experimental condition. The "Net" column is the difference between approval under the treatment and control (relative to approval under the control).

condition among respondents who received the current responsibility prime in consumption terms, rising from 38.39% under the control condition to 48.25%; the latter approval rate is statistically distinguishable from the approval rate under the control condition ($p < .02$) and almost so under the production-based condition ($p < .06$). Perhaps counterintuitively, these results suggest that the framing effects investigated here are most powerful among those voter demographics that are least ideologically inclined to approve of this sort of international environmental policy. We interpret this as evidence that Republicans find the logic of taking personal responsibility for the pollution caused by one's own consumption habits both novel and convincing, such that making this argument in favor of U.S. leadership on climate change has the potential to raise Republican approval levels from a clear minority to almost half of the Republican voting population.

The consumption-based primes had a similarly powerful effect on approval among respondents who described themselves as political independents, but not exclusively so. Within this sub-group, we find that although the consumption-based primes did indeed raise approval rates substantially { a full 10.16 percentage points from 45.25% under the control condition to 55.41% under a consumption-based prime { so too did the production-based prime, which was itself associated with a 9.57 percentage point bump in approval relative to the control. This result is difficult to interpret: the proposed international agreement clearly demands

more of the U.S. than its developing world counterparts, and only the consumption-based primes support that idea with information stressing the role of the developed world in driving global emissions through consumption. We believe that part of the explanation may lie in the fact that independents are significantly less politically engaged on average than their more partisan counterparts³², and they may therefore be more likely to accept any rationale offered as a justification for supporting the agreement.³³

We also found some limited evidence that the size and direction of these framing effects can vary as a result of an interaction between the respondent's political views and the political context prime received. These findings fall just short of accepted standards of statistical significance due to the low sample size within each of these subsets,³⁴ but we mention them here because of the magnitude of these effects and their potential theoretical significance if replicated with a larger number of respondents in future research. Among "strong" and "moderate" Democrats who were told that the agreement has only Republican support, for example, receiving a consumption-based fairness prime actually decreased approval 12.02 percentage points, from 77.27% under the control condition to only 65.25% with the prime ($p < .07$). This suggests that Democrats in this group may have actually seen the agreement as an inadequate Republican-backed response in light of the developed world's degree of responsibility for emissions through consumption. Also worth noting is the counterintuitive result that the greatest gains in approval among Republicans ("strong," "moderate," or "lean"-ing) who received a consumption-based prime took place when they were told that the agreement has either solely Democratic or bipartisan support. Perhaps unsurprisingly, Republicans who were told that the agreement has Democratic support only had the lowest approval rate under no fairness prime at 31.58%, as compared to just over 42% under no

³²The 2012 American National Election Study, for example, found that voter turnout among political independents was self-reported at only 53% that year, while turnout among Democrats and Republicans was self-reported as 81% and 83%, respectively. This information is viewable online at http://www.electionstudies.org/nesguide/2ndtable/t6a_2_2.htm.

³³Please see Table 6 in Appendix D for a recalculation of the results from Table 3 that explores the role of potential swing voters instead of political independents.

³⁴For example, of the 283 "strong" and "moderate" Democrats who received the experimental condition where the agreement only has Republican support, only 66 respondents also received the control condition of no fairness prime addressing current responsibility for emissions.

fairness prime when told that the agreement had either sole Republican or bipartisan support. However, receiving a consumption-based fairness prime was associated with approval rising a full 12.86 percentage points to 44.44% among Republicans told that the agreement had sole Democratic support ($p < .07$). We interpret this result as tentative evidence that describing responsibility for pollution in consumption terms may have some power to convince the unconvinced of the need for U.S. leadership on this politically contentious issue { even in the absence of Republican party support for an agreement³⁵.

3.4.4 Logistic Regression Results

Given the number of treatments administered in this survey experiment, these results could be viewed as vulnerable to inadvertent misattribution of causal effects if we did not confirm that they hold when we control for the effects of all of the treatments simultaneously. Table 3.3 displays the results of our logistic model of agreement approval as a function of the variants of our experimental conditions. Model 1 excludes our six demographic controls of party identification, age, gender, education, race, and region, while Model 2 includes them. In each model, the control condition has been dropped from each categorical variable to avoid multicollinearity. The full logistic regression table including demographic controls is available in the online appendix.

As is evident from a close examination of the results, the logistic regression analysis confirms our findings regarding which treatment conditions have a large, positive, and statistically significant effect on approval of the proposed agreement: future cost, bipartisan support, and a consumption-based moral framing. The magnitudes of these effects are large

³⁵We also found that even respondents who were self-reported climate change skeptics were not immune to the framing effects investigated here. Of the 2,914 respondents who answered our question about agreement approval, 682 said that they either "agree" or "strongly agree" that "the concerns about global warming are overblown." Within this group, we still observed a strong effect for the per capita consumption prime on approval (although we did not observe any effect at all for the aggregate consumption prime). Approval was 10 percentage points higher among skeptics who received the current responsibility prime in terms of per capita consumption relative to the control condition (rising from 51.5% to 61.6%, the difference between a toss-up and a decided majority for agreement support among the skeptics). The difference in these approval levels is statistically significant at a 6% error level. However, we do not have a strong theory as to why hearing about consumption in per capita terms should move this class of respondents while hearing about it in aggregate terms should not.

Table 3.4: Logistic Regression Results, With and Without Demographic Controls

	Dependent variable:	
	Approval	
	(1)	(2)
Higher cost	0.013 (0.092)	0.002 (0.104)
Future cost	0.224 (0.092)	0.264 (0.104)
Republican support	0.027 (0.092)	0.007 (0.104)
Bipartisan support	0.243 (0.092)	0.273 (0.105)
Production framing	0.093 (0.106)	0.046 (0.120)
Consumption framing	0.257 (0.093)	0.211 (0.105)
Historical framing	0.026 (0.075)	0.026 (0.086)
Constant	0.011 (0.110)	1.122 (0.432)
Observations	2,914	2,674
Demographic Controls Included?	No	Yes
Log Likelihood	-1,974.76	-1,614.79
Note:	p < 0.1; p < 0.05; p < 0.01	

relative to the other variants and similar across the two model specifications. To give the reader a sense of the magnitude of these effects in real terms, the average predicted probability of approval if an agreement has no moral framing, Republican support only, and the higher of the two costs (with no information on the future cost of climate change) is 0.49. This rises 18 percentage points to 0.67 if the agreement's fairness is framed in consumption terms, if it has bipartisan support, and if it has the higher cost but with information provided on the future cost of allowing climate change to proceed unchecked³⁶.

3.5 Discussion and Implications

Taken together, our results suggest something optimistic: that there is a way to "sell" American citizens on the importance of U.S. participation in international climate change mitigation efforts, even when those efforts involve substantial household costs. Our findings challenge the conventional wisdom that cost is a central determinant of support for global climate policy and suggest that the most broadly effective argument in favor of U.S. leadership on this issue would include an estimate of the cost of inaction on climate change, information on how developed countries like the U.S. contribute substantially to current global emissions through our consumption habits, and ideally the latter paired with an account of how developed countries as a whole also created this problem in the first place through the rampant production of emissions since the dawn of industrialization. A broad, bipartisan political support base for the proposed international climate policy would also be likely to boost public support considerably.

It is evident that a critical part of this argument is the idea that the U.S. currently contributes to the global warming problem in a substantial fashion, out of proportion to its population. This is clear from the fact that the history argument on its own has no effect on approval while the arguments in terms of current consumption have substantial effects on our respondents' willingness to support U.S. participation in a costly climate agreement.

³⁶These marginals were calculated based on the results of Model 1. When recalculated with the results of Model 2, they remain unchanged except the lower bound is 0.52 instead of 0.49.

Yet the greatest gains in approval came when respondents were presented with a combined version of these two arguments: that developed countries like the U.S. not only contribute substantially to current emissions via their consumption habits, but also created this problem historically. While the historical responsibility prime on its own is largely dismissed, it thus becomes salient when combined with the consumption-based current responsibility primes.

This suggests that respondents are most likely to agree that U.S. participation in a costly climate agreement is appropriate when they are presented with a fairness argument in which the developed world is portrayed as doubly responsible, having both created this problem historically and { importantly { continued to perpetuate it through the consumption habits of its population. It is certainly possible that political entrepreneurs will find resonant ways of expressing the historical fairness argument on its own { for example, with Chinese Vice Foreign Minister He Yafei's memorable dinner metaphor { but framing the issue this way is likely a less than optimal approach when addressing a developed world audience, especially given the likely alternative arguments based in contemporary responsibilities that would be expressed in a real political debate.

Perhaps our most compelling finding for policymakers and environmentalists is that we find evidence that these fairness-based arguments have the greatest impacts within the very voter demographics that are least likely to exhibit high approval levels for costly international climate agreements: Republicans and non-partisan independents. While Democrats may judge these arguments favorably or harshly depending on political context, Republicans in particular consistently find the consumption-based arguments convincing. Democrats also overwhelmingly support the agreement compared to these groups in any case: while overall approval is 42.82% among Republicans and 52.48% among independents, it is 70.74% among Democrats.

To be fair, the design of any survey experiment raises legitimate questions about external validity that merit consideration here. It is possible that some respondents would react differently to the information provided in our treatment conditions when encountered in the real world rather than in an online survey. Our primary interest, however, is in better understanding the factors that are likely to increase popular approval of a costly international

climate agreement. As such, the substantial variation in approval that we observe in response to our experimental conditions provides a good indication of the circumstances under which the public will support U.S. leadership on this issue.

Our aim has been to investigate the roles of fairness, justice, and political context in determining popular support for global environmental policy, with a substantive focus on climate change. We have shown that U.S. voters care less about an agreement's cost than they do about notions of fairness in forming their views of U.S. involvement in international climate policy, and both elite cues and the financial consequences of inaction play an important role in shaping approval as well. We hope that readers will take away two key theoretical contributions. First, the salience to voters of the historical fairness argument that the developed world should contribute to mitigation because it created the climate change problem in the first place is highly contingent on context. Second, our results strongly support arguments that emphasize the role of perceptions of fairness in determining support for costly action. Notably, we find that this is true even for those for whom change is a larger percentage of their monthly income. We have offered tentative explanations for the mechanisms by which these considerations shape opinion formation that we hope future research efforts will be able to explore further.

3.6 Appendix

3.6.1 Appendix A: Sample Demographics

Table 3.5 compares the demographics of our representative sample of voting-age U.S. citizens to those of the U.S. population as a whole. All population demographics reported are percentage estimates from the U.S. Census Bureau for the total U.S. population with the exception of the age and educational attainment estimates, which represent percentages of the U.S. population over the age of 18 to ensure that the sample and population figures for these demographic categories are directly comparable.

³⁷Because our data sorted respondents into age ranges of 18-35, 36-64, and over 65, the corresponding population figures for the first two age categories were estimated based on the U.S. Census data, which breaks

Table 3.5: Demographics in Representative Sample versus U.S. Population

Demographic category	Representative sample	U.S. population
Age		
18-35	35.47	32.31
36-65	49.97	48.93
Over 65	14.56	18.86
Sex		
Female	52.92	50.8
Male	47.08	49.2
Race		
White	64.5	61.3
African American	13.02	13.3
Native American	1.52	1.3
Hispanic	4.77	17.8
Asian	13.61	5.7
Other	2.59	0.06
Educational attainment		
No degree	1.3	11.7
High school degree	28.04	48.05
College degree	51.41	29.05
Post-graduate degree	19.26	11.19
Region		
Northeast	25.95	17.4
South	32.06	37.9
Midwest	21.92	21.0
West	20.07	23.7

at 18-34 and 35-64 instead. These estimates were obtained by assuming equal distribution across each age year and shifting one year's proportion of the total percentage from the older group to the younger group. These percentages were then divided by the total percentage of people over the age of 18 as given by the U.S. Census data so that the sample and population percentages were comparable. The population-level age data is available online at https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_16_5YR_DP05&src=ptThe sex and race demographics are the figures reported for July 1, 2016, within a month of when we ran our study, and they are available online at <https://www.census.gov/>

3.6.2 Appendix B: The Vignette

Global Environmental Policy

The following questions are about U.S. participation in an international agreement on the environment. We will describe a scenario and ask if you would approve or disapprove of U.S. participation.

The Situation

U.S. delegates are meeting with the leaders of other major economies to consider a proposal for how to reduce carbon emissions worldwide.

Based on the recommendations of climate scientists, the proposal would keep global emissions in the "safe zone" through an agreement involving the 15 economies that both produce and consume roughly 80% of carbon emissions worldwide. This group includes countries considered developed by the UN plus all top greenhouse gas emitters among the developing countries.

The proposal asks the following:

All 15 economies, including the United States, are asked to begin immediately decreasing carbon emissions by 2% each year for 40 years.

[quickfacts/fact/table/US/PST045216](https://www.census.gov/quickfacts/fact/table/US/PST045216). The population-level figure reported for White above is listed in the U.S. Census data as "White alone, not Hispanic or Latino," and the population-level figure reported for Hispanic above is listed in the U.S. Census data as "Hispanic or Latino." The discrepancy between the sample and population figures in the latter category is one of the highest in our study, and we attribute it to three contributing factors. First, people who identify as Asian were over-represented in our study while people who identify as Hispanic were underrepresented. Second, it is widely agreed that having Hispanic heritage is not a race category, so some people who identify as white and Hispanic may have selected "White" instead. Third, the sample figure likely does not include Latino respondents, who may have responded "White" or "Other" depending on their background. The population-level figures for educational attainment are those given by the U.S. Census for the population over the age of 18 in 2016 and are available from the "All Races" Excel file available at <https://www.census.gov/data/tables/2016/demo/education-attainment/cps-detailed-tables.html>. Our sample of online recruits is better educated than the general population, which is unsurprising given that recruitment took place online and therefore required access to a computer with an internet connection, time to take the survey, and a general awareness of the ability to be compensated for taking surveys online; it is important to bear this in mind when interpreting our treatment effects. The population-level region demographics are the figures given by the U.S. Census data for 2016 and are available online at https://www.census.gov/popclock/data_tables.php?component=growth.

The developed countries agree to transfer a fund of \$50 billion per year to the developing world to help them reduce emissions and adapt. The developed countries will contribute to the fund in proportion to the sizes of their economies.

[Randomized variant of the Political Context Treatment.]

The deal was negotiated between these developed and developing countries with the following in mind:

The global warming problem is costly, and it cannot be solved without the participation of both developed and developing countries³⁸.

[Randomized variant of the Economic Cost Treatment.]

[Randomized variant of the Current Emissions Treatment.]

[Randomized variant of the Historical Emissions Treatment.]

3.6.3 Appendix C: The Role of Potential Swing Voters

In Table 3.6, we showed how approval levels were affected by each of the fairness primes relative to the control condition within each of three sub-groups based on our respondents' political party identification. The "Democrats" sub-group contained all respondents who described themselves as a "Strong Democrat," a "Moderate Democrat," or someone who "Leans Democratic," and the "Republicans" sub-group contained all respondents who described themselves with the analogous terms for Republicans. The "Independents" sub-group included all who described themselves as "Independent" rather than selecting one of the other categories above in a 7-point Likert-type scale.

In Table 6, we display the effects of breaking the political identification scale a different way, with "Democrats" and "Republicans" including only those respondents who described themselves as "Strong" or "Moderate" members of those categories. Our middle category becomes a representation of potential swing voters, including both political independents and respondents with low self-reported party loyalty who only "lean" towards one over the

³⁸The visual order of the following three treatments was randomized in addition to the variants themselves.

Table 3.6: Approval by Fairness Prime and Party ID, with Focus on Potential Swing Voters

Condition	Democrats N=883		Potential Swing Voters N=1,347		Republicans N=684	
	Approval	Net	Approval	Net	Approval	Net
Control	74.62		49.57		36.20	
Production	70.54	4:08	54.47	49	40.45	425
Consumption	74.68	006	55.27	57	48.69	1249**

** Indicates that the net difference in approval between the treatment and control conditions is significant at $p < .05$ in a two-sample difference in means t-test with Welch's adjustment for unequal variances. The "Approval" column is the percent of respondents in that party sub-group who approved of the proposed agreement after receiving that row's experimental condition. The "Net" column is the difference between approval under the treatment and control (relative to approval under the control).

other. When we recode these sub-groups this way, we again find that our largest effects on approval took place among Republicans who received a fairness prime emphasizing the role of developed world consumption habits in driving global emissions.

3.6.4 Appendix D: Political Context, Political Views, and Fairness

We find evidence that partisan cues and attitudes interacted with the effects of fairness primes in several ways worth noting. First, we were interested in whether the framing effects that we found in the pooled data held for the subsets of respondents who received each of the political context experimental conditions. We found that, of all the current and historical responsibility primes, the only ones to have a statistically significant effect within these sub-groups were again those primes given in consumption terms, and only within the sub-group of respondents who were also told that the agreement was supported by a Democratic president with Republican opposition in Congress. Among this group, approval was 10.1 percentage points higher among respondents who received the consumption prime in aggregate terms than it was among respondents who received the current responsibility control condition (rising from 49.56% approval to 59.66%), and it was 10.01 percentage points higher among

those who received the consumption prime in per capita terms (rising from 49.56% approval to 59.57%)³⁹

In contrast, these framing effects were almost invisible among respondents told that the agreement was supported by a Republican president, and they were visible but not statistically significant among respondents told the agreement had bipartisan support. It should be noted, however, that respondents who were told the agreement had bipartisan support overall approved of the agreement by a considerable margin (ranging from 57.32% under the current responsibility control condition to 64.76% under the condition with consumption information given in aggregate terms); the framing effects were simply not found to be statistically significant in further increasing approval within this sub-group.

3.6.5 Appendix E: Treatment Effects Across Demographics

We find some heterogeneity worth noting in the overall treatment effects within particular demographic sub-groups of our respondents. First, education level appears to interact with the strength of the effect of elite cues on approval. While we do not observe a significant departure from the overall framing effects when we disaggregate our respondents by whether or not they have a college degree, we do find that our respondents without a college degree responded more strongly to the political context conditions than did our college-educated respondents. Specifically, while respondents with a high school education or no degree had almost exactly the same approval rate when told that the agreement was supported by a Democratic president as by a Republican president, approval was 9.65 percentage points higher relative to the control within this sub-group when told that the agreement had bipartisan support instead (rising from 49.3% to 58.9%)⁴⁰.

This suggests that U.S. citizens with lower levels of education might rely more on elite cues in public opinion formation on such policy matters than their college-educated coun-

³⁹Within this sub-group of respondents who were told the agreement was supported by a Democratic president, both of these approval rates are distinguishable from the approval rate under the control condition at a 3% error level, respectively.

⁴⁰This difference is statistically significant at a 3% error level.

terparts. In contrast, approval was only 4 percentage points higher among college-educated respondents when they were told the agreement had bipartisan rather than Democratic support (rising from 59.4% to 63.7%), and it was 6 percentage points higher relative to when they were told the agreement had Republican support (rising from 57.7% to 63.7%). Only the difference between the approval levels under bipartisan support and Republican support was statistically distinguishable, and even then the same approval bump among the non-college-educated respondents was over 50% higher.

When we disaggregate by age instead, we find that the most salient difference in treatment effects among age groups is sensitivity to cost. While the young appear to be most concerned by the future cost of inaction on climate change, the middle-aged seem most sensitive to doubling the cost of the proposed agreement and the elderly appear the least concerned with cost entirely. If we consider young people to be aged 18-35, this sub-group starts with extremely high approval and sees it rise 7 percentage points further relative to the control (from 70.5% to 77.8%) when informed of the financial cost of allowing climate change to proceed unchecked; however, this group is largely unmoved by the prospect of doubling the cost of the agreement. In contrast, if we consider the middle-aged to be 36-60 years old, this sub-group starts with markedly lower approval levels that drop 7 percentage points further relative to the control (from 52.6% to only 45.6%) when the cost of the agreement is doubled; this group is largely unmoved by the specter of the future cost of unchecked climate change.⁴¹ These effects make sense if we assume that young people are more likely to believe that they will live to see the negative consequences of climate change left unchecked, while middle-aged people are more likely to have financial obligations (to mortgages, dependents, retirement accounts, and so on) that could cause concerns about personal financial sacrifices to outweigh concerns about future costs they may not live to see.

By a similar logic, then, it is perhaps unsurprising that the elderly appear to be least supportive of the climate agreement under the control condition but also the least sensitive to concerns about the agreement's cost. If we consider the elderly to be those who are 61 or

⁴¹These differences in approval cited here within the young and middle-aged sub-groups are statistically significant at a 4% and 5% error level, respectively.

older, this sub-group exhibits the lowest overall approval levels of any age group (starting at 38.5% under the control condition), and approval rises approximately 8.5 percentage points under both conditions where the cost of the agreement is doubled, including the condition in which the future cost of inaction on the issue is also emphasized (to 47% and 47.3%, respectively).⁴²

We observe still another kind of disparity in the treatment effects when the data is broken out by gender. First, it must be noted that we saw significantly higher overall approval of the proposed agreement among the men in our sample than among the women, despite there being no large differences in either their mean or median self-ranking of their political affiliation (from 1 for "strong Democrat" to 7 for "strong Republican"): overall approval among men was 65% while it was only 52% among women. Second, we found that while neither gender sub-group's approval moved in response to doubling the cost of the proposed agreement, women were much more responsive than men to the treatment condition emphasizing the future cost of allowing climate change to proceed unchecked. Among men, there was no statistically distinguishable difference in approval across any of the three experimental conditions in the cost category, whereas approval among women rose 9 percentage points relative to the control (from 48.5% to 57.8%) under the condition emphasizing the future cost of inaction on the issue.⁴³ In contrast, men were much more responsive than women to the fairness primes in the current responsibility category (even though, consistent with our other findings, neither gender cared about the fairness prime in the historical responsibility category). While there was no statistically distinguishable difference in approval among women who heard any of the fairness primes, approval among men was 8 percentage points higher relative to the control (rising from 60.6% to 68.3%) under the condition with the fairness prime in per capita consumption terms and 7 percentage points higher with it in aggregate consumption terms.⁴⁴

⁴²However, there is some additional uncertainty surrounding these effects as they are only significant at an 8% error level.

⁴³The difference in these approval levels is statistically significant at a 1% error level.

⁴⁴These differences in approval are significant at a 5% and 8% error level, respectively.

Finally, when we disaggregate the data by race, we find that different treatment conditions were most salient to different racial sub-groups. Among respondents who identified themselves as white, several treatment conditions were associated with significant increases in approval: the cost condition emphasizing the future cost of inaction on climate change (in which approval rose 7.43 percentage points relative to the control from 50.4% to 57.8%), the condition with the fairness prime given in terms of aggregate consumption (in which approval rose 9 percentage points relative to the control from 49.7% to 58.6%), and the political context condition in which the agreement has bipartisan support (in which approval rose 7 percentage points relative to the control from 50.3% to 57.2%)⁴⁵. White respondents were indifferent to cost, single-party support, and all of the other fairness primes. In contrast, the sub-group of respondents who identified themselves as Hispanic only saw a statistically significant bump in approval under the cost condition emphasizing the future cost of inaction on climate change, but this effect was massive: approval was fully 26 percentage points higher under this condition relative to the control (rising from 56.5% to 82.5%)⁴⁶. In still greater contrast, none of the experimental conditions were associated with a significant boost in approval within the sub-groups of respondents who identified as either African American or Asian. However, it should be noted that all of the non-white sub-groups exhibited much higher overall support of the agreement than their white counterparts: while overall approval was 52.8% among white respondents, it was 64% among African Americans, 68.2% among Hispanics, and 74.9% among Asians.

It is also worth noting that the only race-based sub-group that saw a significant increase in approval when told the agreement has bipartisan support is that of white respondents. One possible explanation for this is that members of racial minorities may not on average feel as politically represented or as trusting of political elites as their white counterparts. If true, this might dramatically reduce the extent to which they view bipartisan elite support as a signal that the climate agreement has been well-vetted and must be a good idea.

⁴⁵Each of these differences in approval under the condition listed here and its respective control are statistically significant at a 1%, 1%, and 2% error level, respectively.

⁴⁶This difference in approval is significant at a 1% error level.

3.6.6 Appendix F: Full Logistic Regression Results

Table 3.7: Specification with All Demographic Controls and Both Consumption Primes

	Dependent variable:
	Approval
Higher cost	0.002 (0.104)
Future cost	0.265 (0.104)
Republican support	0.007 (0.104)
Bipartisan support	0.272 (0.105)
Production framing	0.046 (0.120)
Consumption framing	0.253 (0.124)
Consumption per capita framing	0.174 (0.120)
Historical framing	0.028 (0.086)
Moderate Democrat	0.335 (0.162)
Lean Democrat	0.727 (0.172)
Independent	1.151 (0.143)
Lean Republican	1.384 (0.187)
Moderate Republican	1.301 (0.182)
Strong Republican	1.710 (0.200)
Age 26-30	0.006 (0.191)
Age 31-35	0.182 (0.185)
Age 36-40	0.567 (0.181)
Age 41-45	0.907 (0.187)

Age 46-50	0.914 (0.187)
Age 51-55	1.066 (0.182)
Age 56-60	1.137 (0.198)
Age 61-65	0.978 (0.199)
Age 66-70	1.307 (0.189)
Age 71-75	1.085 (0.247)
Age 76-80	1.080 (0.372)
Over age 80	1.255 (0.550)
Female	0.280 (0.090)
High school education	0.458 (0.385)
College education	0.615 (0.381)
Post-graduate education	0.807 (0.390)
African American	0.225 (0.141)
Native American	0.171 (0.346)
Hispanic	0.119 (0.215)
Asian	0.452 (0.146)
Other race	0.499 (0.266)
South resident	0.031 (0.114)
Midwest resident	0.106 (0.124)
West resident	0.003 (0.129)
Constant	1.130 (0.433)
<hr/>	
Observations	2,674
Log Likelihood	-1,614.582

Akaike Inf. Crit.	3,307.164
Note:	$p < 0.1$; $p < 0.05$; $p < 0.01$

CHAPTER 4

The Identity Politics of Sustainable Consumption

"If I had one thing to do over again, I would not have talked so much about green."

General Electric CEO Jeffrey Immelt,
on GE's Ecomagination initiative¹

4.1 Introduction

Consumption patterns play a major role in driving climate pollution and other forms of environmental degradation, but it remains an open question whether consumer acceptance of and demand for sustainable products can play a meaningful role in reducing negative environmental impacts. This is due in large part to the fact that the determinants of sustainable consumption itself remain poorly understood (Carrington, Neville, and Whitwell 2010). To date, it has proven difficult for energy efficient, low carbon, or otherwise "green" products to gain market share, and—as General Electric CEO Jeffrey Immelt has pointed out—there even appear to be downsides to marketing green products as green, something that has been called the "sustainability liability" in the marketing literature (Peattie 2001; Bonini and Oppenheim 2008; Luchs, Naylor, Irwin et al. 2010). Empirical studies of sustainable consumption and other types of ethical consumerism have revealed many puzzling trends of this kind that limit efforts to nudge consumers toward more environmentally conscious purchases².

¹"GE's Immelt wishes he had soft-pedaled green talk," Reuters, 3 May 2011.

²For more on the concept of nudging, see Thaler and Sunstein 2008.

Within the literature, research on sustainable consumption has proceeded in a fragmented fashion, across disciplines ranging from economics to marketing to psychology. In many cases, these efforts have proven complementary. Whereas a classical economist would reasonably theorize that individual consumers have a stable utility structure pertaining to sustainability that is expressed through their purchase decisions, many studies have suggested that sustainable consumption and other forms of ethical consumerism are difficult to explain without insights from psychology and marketing as to how an individual's preferences at a given time can be shaped by situational factors (Gershoff and Irwin 2011). Even consumers who value protecting the environment frequently exhibit a "green gap" between their values and actions when it comes to their consumption habits (Johnstone and Tan 2015; Zabkar and Hosta 2013), and when consumers do buy green their purchase behavior tends to be fickle and highly dependent on context (Irwin and Naylor 2009).

Few studies, however, have rigorously examined the role that political identity plays in consumer behavior (Jung, Garbarino, Briley et al. 2017). Even fewer studies have looked at the role of political identity in shaping sustainable consumption choices in particular. There are a few notable exceptions. In a study with particular relevance to this project, researchers found that liberal consumers chose to purchase an energy-efficient light bulb over a default alternative in greater numbers than conservatives, but only when it was both more expensive and marketed with a "save the environment" sticker (not when either of those factors was present without the other) (Gromet, Kunreuther, and Larrick 2013). However, the study was conducted on a small sample of university students and left open the question of whether marketing that motivated energy efficiency in other ways would be less politically polarizing to consumers³. Further research is needed to parse more systematically the dynamics of how consumer political identity affects consumption choices, and political psychologists have begun calling for further work to be done in this area (Jost 2017).

This study develops a theoretical framework that leverages insights across disciplines

³Gromet has highlighted this as an important direction for future research in the press. See Brian Handwerk, "Pro-Environment Light Bulb Labeling Turns Off Conservative Buyers, Study Finds," *National Geographic News* 1 May 2013.

to explain sustainable and other ethical consumption choices as manifestations of identity politics. As we articulate at greater length in the following section, we theorize that a consumer's political identity will interact with the purchase-motivating message embedded in how a product is marketed, shaping the consumer's willingness to pay for that product. When the way a product is marketed makes the purchase decision salient as a moral choice about whether to contribute to a cause that has been politicized, consumers will tend to make the decision they perceive as most consistent with their political identity. This effect should be especially discernible in situations of strong political polarization that provoke in-group and out-group dynamics among partisans.

In the context of sustainable consumption, we expect products that are marketed as good for the environment to be politically polarizing to U.S. consumers due to the extent to which the sustainability cause has been politicized as a "liberal" cause in American politics. We also expect that conservative U.S. consumers will be more willing to pay for the same product when it is instead marketed with messaging that more closely aligns conservative values. Put differently, we theorize that the interaction between consumer political identity and product marketing produces a positive associative effect on willingness to pay when the marketing aligns the values popularly associated with the consumer's political in-group. We expect to observe a discernible but weaker dissociative effect that lowers willingness to pay when a product's marketing is popularly associated with the consumer's political out-group instead.

We develop a series of hypotheses regarding these effects in the section that follows, after which we report the results of an innovative large-N field experiment involving both stated preferences and actual consumer purchases that we conducted to test our hypotheses on a representative sample of the U.S. voting-age population. We take as our empirical focus the determinants of willingness to pay for energy efficiency among liberal versus conservative consumers when choosing which light bulbs to purchase for use in their homes. After collecting information on our respondents' political beliefs, our survey randomized our respondents into one of three marketing treatments, each of which presented a different image of the packaging for an energy-efficient light bulb. In our control treatment, the packaging simply

marketed the bulb's energy efficiency as producing "great savings." Our first experimental treatment marketed the bulb's energy efficiency with broadly liberal values, emphasizing it as being "great for the environment." Our second experimental treatment marketed it using broadly conservative values, as being "great for America's energy independence." We then presented respondents with a total of six conjoint choice sets, each of which presented two light bulbs that varied in their price, lifespan, and level of energy efficiency. The first five choice sets simply measured respondents' stated preferences, but for the final choice set we provided them with a cash gift to spend on actually purchasing one of the two light bulbs. We used these data to look for evidence that an interaction effect between consumer political identity and the marketing treatment received shaped our consumers' willingness to pay for energy efficiency.

Our results suggest that political identity is essential to a full understanding of consumer behavior, that consumption itself can be a realm of political action and dynamics, and that a better understanding of these processes could be leveraged to encourage more sustainable popular consumption. We make several distinct contributions. First, we show that liberal consumers are, in general, more willing to pay for energy efficiency than are conservative consumers, which is consistent with the expectation that consumer behavior will generally reflect one's political values. Second, we show that when conservative consumers are shown a product that markets energy efficiency in a way that better reflects conservative values, they can be induced to a similar willingness to pay as their liberal consumer counterparts. This is consistent with the notion of an associative effect in consumer behavior. Third, we find much stronger evidence for the associative effect than for the dissociative effect, which suggests that the pull to behave consistently with one's political in-group is stronger for most consumers than is the desire to reject messaging associated with one's political out-group. Finally, we find some evidence that the apolitical messaging emphasizing simple cost savings in our control treatment was the least effective at increasing willingness to pay for energy efficiency among both liberal and conservative consumers. This suggests that most consumers may prefer to be given a greater reason for making a purchase { even when that reason more closely reflects one's political out-group than one's political in-group. Taken together, these

findings suggest that consumer political identity is an important and underexplored driver of consumer behavior, and this insight has the potential to be leveraged for the social good.

4.2 Political Identity and Economic Decision-making

Informed by insights from sociology and psychology, a robust literature in political science has investigated the dynamics of identity politics, in which political behavior is understood as motivated by group competition originating in differences in social identity (Monroe, Hankin, and Vechten 2000). While many popular definitions of identity politics focus solely on the intersectionality of racial, ethnic, or religious identity with political identity, political scientists have long theorized that a person's political identity itself is an important and largely stable form of social group identification in its own right that shapes various aspects of political behavior (Green, Palmquist, and Schickler 2002). Relatively little scholarly attention has been paid to investigating the effects of political identity on ostensibly apolitical behaviors like consumer choices, likely because until recently it has not been evident why consumer behavior should be of interest to political scientists.

Increasingly, however, political scientists are noting that consumer choice can be a form of political action, a brand of "politicized consumption" in which consumers use their shopping dollars to support or boycott particular causes and practices (Hainmueller, Hiscox, and Sequeira 2015). One recent study found evidence that political identity shapes economic behavior even when that behavior is not explicitly political, revealing that partisans exhibit a discernible preference to work for co-partisan employers and consume goods sold by co-partisans in the marketplace (McConnell, Margalit, Malhotra et al. 2018). The implication is that the in-group versus out-group dynamics that characterize identity politics spill over from explicitly political contexts to other areas of everyday life, including economic settings.

While research on the role of political identity in economic behavior has been limited in political science, a far more robust literature in psychology has explored the links between identity and economic decision-making. The idea that a person's decisions are bounded by identity-based concerns about what the decision-maker's in-group "ought" to do in a given

situation has a long history in the psychology literature (March 1994). Recent work has coined the term "identity economics" to describe how people trade off financial considerations against their desires to behave in ways that are consistent with their identities (Akerlof and Kranton 2010). There is evidence from social psychology, for example, that people engage in "identity-signaling" when choosing possessions and other expressions of taste (Berger and Heath 2008).

This sort of signaling behavior can include abandoning consumer choices that might signal undesired identities. It has been shown that consumers especially wish to avoid products associated with a dissociative reference group, meaning a group with which an individual is especially motivated to avoid association (White and Dahl 2007). In a polarized political context, it is reasonable to ask whether some individuals may see those on the opposing end of the political spectrum as members of a dissociative reference group and make choices { including consumer choices { that they view as consistent with their political in-group and inconsistent with dissociative political groups. Indeed, social psychologists have argued that the intense us-versus-them discourse that tends to dominate modern American politics is likely to cause political conflicts to become salient in such nonpolitical contexts (Seyle and Newman 2006). However, it is worth noting that a robust literature in psychology also suggests that in-group favoritism is often considerably stronger than and largely independent of out-group antipathy (Brewer 1999).

There is also evidence from psychology that individuals tend to make choices that are consistent with a particular social identity after that identity has been made salient to them with a prime. In other words, the preferences expressed by individuals can depend on which "self" is salient at the moment of choice (LeBoeuf, Shafir, and Bayuk 2010). The original study that documented these effects focused on social identities like "family member" or "American," but it is plausible to believe that this tendency would extend to political identities like "liberal" or "conservative." A product's presentation at the point of purchase could also reasonably make a consumer's political identity salient if one is being asked to pay to contribute to a politicized cause.

Such effects of identity salience can be powerful, and perhaps especially so when it comes

to a highly politicized issue like environmentalism (at least in the U.S. context). One study found that the salience of an individual's partisan identity affected the extremeness of the views that the same individual expressed on climate change after priming (Unsworth and Fielding 2014). There is also evidence to suggest that American liberals and conservatives tend to have very different reactions to the moralism of popular pro-environment messaging. It has been shown, for example, that most environmental rhetoric is framed in moral terms that liberals find much more persuasive than conservatives. Several studies have shown that when pro-environment rhetoric is reframed in moral terms that evoke authority, purity, health, or patriotism, the gap in environmental attitudes between partisans is considerably reduced (Feinberg and Willer 2013; Wolsko, Ariceaga, and Seiden 2016; Petrovic, Madrigano, and Zaval 2014).

In the economics literature, the theory of conspicuous consumption also implies that political identity could play a role in sustainable consumption decisions. There is empirical evidence to suggest, for example, that individuals are disproportionately willing to pay a premium for a Prius in communities where environmentalism is especially prized, a phenomenon that has been interpreted as a form of status-seeking (Sexton and Sexton 2014). If most of these status-seekers are politically liberal and seeking status among fellow liberals, such in-group dynamics might incline a politically conservative observer *not* to buy a Prius to avoid signaling an unwanted identity. Such negative sustainable consumption choices can be interpreted as negative externalities of the social dynamics between political groups.

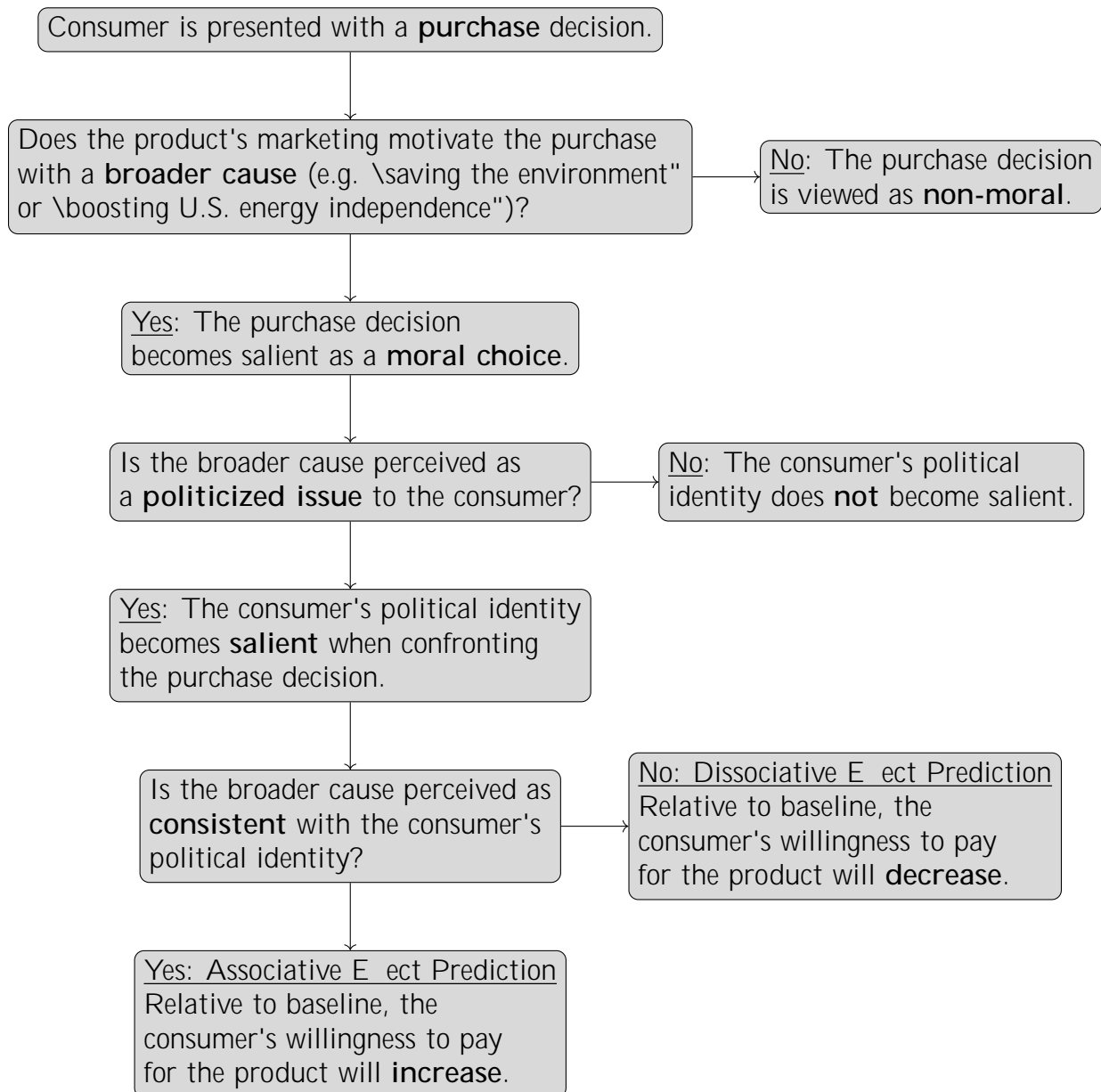
Collectively, these insights across political science, psychology, and economics underpin the theoretical framework we develop here regarding the identity politics of sustainable consumption. We take as our starting point three well-established insights from the psychology literature on identity. First, we assume that individuals wish for their behavior to comport with their sense of their own identity (Higgins 1987). Second, we assume that most individuals wish to view themselves as moral actors (Benabou and Tirole 2011; Aquino and II 2002). Within this framework, individuals will interpret some decisions as moral in nature and derive utility when they act in ways that are consistent with their impressions of themselves as moral beings. Finally, we assume that an individual's identification with a particular

political identity implies their identification with a general moral logic that forms at least one basis for their decision-making (Graham, Haidt, and Nosek 2009).

Building on these insights, we theorize that while many purchases are likely perceived as wholly non-moral and non-political to the common consumer, factors like a higher price point and a marketing message that motivates the purchase with a broader purpose (like "saving the environment") can make certain purchase decisions salient to the consumer as *moral choices* about whether to incur a cost to support a cause. When the cause in question has been politicized, the consumer's political identity will become salient when making the purchase decision and shape willingness to pay for the product. Consumers who view supporting that cause as consistent with their political identity will be more likely to see purchasing the product as virtuous and derive utility from acting consistently with in-group values, while others will be more likely to be unmoved or even reject the product. Put differently, if the cause is perceived as congruent with the values popularly associated with the consumer's own political identity and in-group, we expect to observe a positive effect on willingness to pay that we call the *associative effect*. If the cause is perceived as congruent with the values associated with a political out-group instead, we expect to observe a *dissociative effect* that lowers willingness to pay. Consistent with insights from the existing literature, we expect in-group favoritism to be stronger than out-group antipathy such that associative effects are stronger than dissociative effects (Brewer 1999; McConnell, Margalit, Malhotra et al. 2018). Figure 4.1 provides a visualization of the theory, capturing how certain purchase decisions cause the consumer's political identity to become salient and produce these associative and dissociative effects as manifestations of identity politics.

As we will describe at greater length in the following section, we evaluate this theory by measuring the responsiveness of liberal and conservative consumers to three types of product messaging, each of which emphasize a different motivating reason to prioritize energy efficiency when purchasing light bulbs for use in one's home: because it is good for cost savings (our control condition), because it is good for the environment (our experimental treatment invoking the popularly liberal value of environmentalism, or because it is good for U.S. energy independence (our experimental treatment invoking the popularly conservative

Figure 4.1: A Visualization of Consumer Choice as a Manifestation of Identity Politics



value of patriotism). As our baseline expectations, we hypothesize that even under the control condition liberal consumers will be more willing to pay for energy efficiency than conservative consumers, simply because it is likely that any dedicated environmentalists who will seek out the most sustainable option in any treatment setting will identify as liberal. We call this the *Liberal Sustainability Bias Hypothesis*.

Liberal Sustainability Bias Hypothesis: Under the control condition, liberal consumers will be more willing to pay for energy efficiency than conservative consumers.

Because the sustainability cause has been politicized in U.S. politics as a "liberal" cause, we expect that liberal and conservative consumers will react differently to the product messaging that energy efficiency is good for the environment. We hypothesize that liberal consumers will be most responsive to the environmentalist messaging and discernibly more so than conservative consumers under this treatment. Relative to the other two treatments, we also expect conservative consumers' willingness to pay for energy efficiency to be lowest when treated with environmentalist messaging. We refer to these expectations as the *Liberal Associative Effect Hypothesis* and the *Conservative Dissociative Effect Hypothesis*, respectively.

Liberal Associative Effect Hypothesis: When treated with environmentalist messaging, liberal consumers will be most willing to pay for energy efficiency relative to the other two treatments and significantly more so than conservative consumers.

Conservative Dissociative Effect Hypothesis: Conservative consumers will be least willing to pay for energy efficiency when treated with environmentalist messaging, although this decrease relative to the control will be smaller than the boost associated with patriotic messaging.

We have the inverse expectations associated with the marketing treatment that emphasizes energy efficiency as "great for America's energy independence," which we visually pair

with red, white, and blue American flag imagery to evoke an appeal to patriotism. Because this is a cause that has been politicized in U.S. politics as "conservative," we hypothesize that conservative consumers will respond the most to the patriotic messaging relative to the other two treatments and will do so on a level that is similar to liberal consumers' responsiveness under the environmentalist messaging. We also hypothesize that liberal consumers' willingness to pay for energy efficiency will be lowest when treated with patriotic messaging, relative to the other two treatments. We call these expectations the *Conservative Associative Effect Hypothesis* and the *Liberal Dissociative Effect Hypothesis*, respectively.

Conservative Associative Effect Hypothesis: When treated with patriotic messaging, conservative consumers will be most willing to pay for energy efficiency relative to the other two treatments and display a similar responsiveness to liberal consumers under environmentalist messaging.

Liberal Dissociative Effect Hypothesis: Liberal consumers will be least willing to pay for energy efficiency when treated with patriotic messaging, although this decrease relative to the control will be smaller than the boost associated with environmentalist messaging.

Finally, we develop one further expectation regarding the overall effects of the three marketing messages. When we examine the effects of the experimental conditions on willingness to pay for energy efficiency without taking into account our consumers' political identities, we hypothesize that the most effective one will be the control condition emphasizing the cost savings associated with energy efficiency. This expectation follows from our earlier hypotheses, because we expect the two ideologically motivated treatments to polarize the willingness to pay of our liberal and conservative consumers. We refer to this as the *Cost Savings Dominance Hypothesis*.

Cost Savings Dominance Hypothesis: Mass willingness to pay for energy efficiency will be highest under the control condition.

4.3 Survey Design and Data

To test these hypotheses, we administered an online survey to a nationally representative sample of voting-age U.S. adults⁴ in April 2018 and collected a sample of 1,802 completed surveys.⁵ Appendix A contains a table comparing the socio-demographics of our sample to those of the U.S. population. At the outset of the survey, respondents were randomized into one of three survey types corresponding to our three treatments, which will be explained in detail below. The survey module can be viewed in its entirety in Appendix B.

The survey opened by gathering data on the respondents' political beliefs, values, and light bulb use. Next, as shown in Figure 4.2, the survey introduced one at a time the three features of light bulbs { price, lifespan, and level of energy efficiency } that would vary in the choice sets that would later be presented to them. These displays were shown on three successive screens to encourage reading comprehension and reduce text fatigue. Collectively, they explained to respondents how each attribute typically motivates consumer purchase decisions and defined their typical attribute ranges. Respondents were then asked to rank these attributes in order of their importance to them when purchasing light bulbs.

Next, respondents were shown one of three treatments, each of which constructed a different logic model for why a consumer might prioritize energy efficiency when choosing a light bulb to purchase. Each of the three explanations were accompanied by a visual prime displaying an image of light bulb packaging that marketed the product with the motivation for energy efficiency highlighted in the logic model. These visual primes are shown side by side in Figure 4.3.⁶ In the Liberal Values Treatment, respondents were treated with environmentalist messaging informing them that energy efficient light bulbs "reduce the greenhouse gas emissions that cause climate change"; the visual prime displayed a green

⁴We worked with the GfK Group, formerly Knowledge Networks, to conduct this study. The sample was drawn from GfK's KnowledgePanel, which is a probability-based web panel designed to be nationally representative.

⁵Of the respondents who completed an initial screening question, roughly 48.5% both qualified as potential light bulb purchasers for their household and completed the survey in its entirety.

⁶The authors thank Christian Zarate, Communications Specialist for the UCLA Luskin Center for Innovation, for designing these primes.

Figure 4.2: Light Bulb Attribute Descriptions with Typical Ranges, As Displayed

(a) Price

The **price** of the light bulb describes how much it will cost you to purchase it. The typical price of a light bulb can vary from \$1.99 to \$4.99 depending on who produces it, how long it lasts, and how energy efficient it is.

Light Bulb Feature	Typical Range
1. Price: How much does it cost you to purchase?	\$1.99 to 4.99

(b) Lifespan

A second feature is the **lifespan** of the light bulb. This describes how many years the light bulb will last before it burns out and needs to be replaced. The lifespan of a light bulb can vary from 1 to 10 years or more depending on its type and quality.

Light Bulb Feature	Typical Range
1. Price: How much does it cost you to purchase?	\$1.99 to 4.99
2. Lifespan: How long will it last in your home?	1 to 10 years

(c) Energy Efficiency

A third feature is the **energy efficiency (or cost of operating) of the light bulb**. This describes how much energy the light bulb uses in a year, which shows up as costs on your electric bill.

Light bulbs with an **Excellent** energy efficiency rating are the cheapest to operate. The energy efficiency of a light bulb can range from \$1.00 in energy costs per year to \$4.80 per year, depending on whether its rating is **Excellent**, **Good**, **Fair**, or **Poor**.*

Light Bulb Feature	Typical Range
1. Price: How much does it cost you to purchase?	\$1.99 to 4.99
2. Lifespan: How long will it last in your home?	1 to 10 years
3. Energy Efficiency Rating (and cost to you per year)	Excellent to Poor (\$1.00 to \$4.80 per year)

* This assumes average hours of light bulb use and electricity costs for the typical U.S. household.

Figure 4.3: Selling Energy Efficiency with Environmentalism, Cost Savings, and Patriotism



earth symbol and the slogan "Great for the Environment." In the Savings Treatment, our control condition, respondents were treated with messaging that simply emphasized the frugality of the purchase. Respondents were told that energy efficient light bulbs "save you money by reducing how much you spend on electricity each year"; the visual prime displayed a pink piggy bank with a dollar symbol and the slogan "Great Savings." In the Conservative Values Treatment, respondents were treated with a patriotic messaging informing them that energy efficient light bulbs "reduce America's dependence on the foreign countries that we currently purchase oil and natural gas from"; the visual prime displayed red, white, and blue American flag imagery and the slogan "Great for America's Energy Independence."

Respondents were then informed that on the next few screens they would be asked to select a light bulb from two possible choices. They were also told that at the end of the survey they would be given a cash gift of \$5 to purchase one of the light bulbs in the final choice set, which would be subsequently mailed to them. Consistent with recommended strategies to reduce hypothetical bias in experimental economics, respondents were informed that their responses on the initial set of questions would have a positive impact on their future utility (Carson and Groves 2007): their purchase options in the final choice set would

depend on how they responded to the initial choice sets. The difference between the price of the chosen light bulb and the amount of the cash gift was theirs to keep, so the final choice set entailed an actual purchase. This aspect of our survey design enabled us to collect data on both the stated and revealed preferences of our respondents.

Next, respondents were shown a total of six choice sets, each containing two light bulbs with varying values for price, lifespan, and level of energy efficiency. The levels for these three attributes were varied as shown in Table 4.1, and Figure 4.4 shows an example of the choice set display as it was seen by respondents. The attribute levels themselves were chosen to represent the typical ranges found in the marketplace, and the price levels in particular were chosen to span the full range of the \$5 cash gift with which respondents were provided.⁷

Table 4.1: Levels for the Three Light Bulb Attributes

Attribute	Levels
Price	\$1.99 \$2.99 \$3.99 \$4.99
Lifespan	1 year 2 years 5 years 10 years
Energy Efficiency	Excellent (\$1.00 per year) Good (\$2.00 per year) Fair (\$3.50 per year) Poor (\$4.80 per year)

⁷In the case of lifespan and energy efficiency, the attribute levels were chosen to span the ranges indicated on the Energy.gov website at <https://www.energy.gov/energysaver/save-electricity-and-fuel/lighting-choices-save-you-money/how-energy-efficient-light>.

Figure 4.4: Light Bulb Choice Set Display

Light Bulb Feature	Bulb 1	Bulb 2
Price: How much does it cost you to purchase?	\$1.99	\$4.99
Lifespan: How long will it last in your home?	1 year	5 years
Energy Efficiency Rating (and cost to you per year)	Fair (\$3.50 per year)	Good (\$2.00 per year)
My choice:	<input type="radio"/>	<input type="radio"/>

To design the choice experiment, we used ChoiceMetrics' Ngene software to generate a Bayesian D-efficient multinomial experimental design. This design would be efficient in the sense that it minimized the variance of the estimated coefficients for the utility function we specified to underpin the multinomial logit model that we would fit to our data. To accomplish this, we employed a modified Federov algorithm in Ngene that permitted us to extract maximal information from our choice experiment by minimizing the variance-covariance estimator of the vector of coefficients for the specified utility function. We then selected the experimental design with the smallest D-error, defined as the determinant of the asymptotic variance-covariance matrix, that also contained no strictly dominated choices. We increased efficiency further by specifying Bayesian priors for the coefficients of each of the light bulb attributes in the specified utility function, because it has been shown that an experimental design's efficiency is much improved even by defining the sign of those parameters (Scarpa and Rose 2008). We assumed negative a priori distributions for the coefficients on price and energy efficiency (defined as operating cost per year, as shown in Table 4.1), because higher costs for either attribute would almost certainly decrease the likelihood that a bulb is chosen on average. Conversely, we assumed a positive a priori distribution for the coefficient on lifespan, because longer light bulb longevity would almost certainly increase the likelihood that a bulb is chosen on average. This produced a design containing 60 choice sets from which each respondent's 6 choice sets were drawn at random.

4.4 Model Specification

To compare willingness to pay for energy efficiency across sub-groups and treatments, we estimate a series of conditional logit models. The standard conditional logit is an extension of the multinomial logit model that is well suited to modeling a choice outcome as a function of the attributes of the choice alternatives. The coefficients on each attribute estimate how much a unit change in that attribute affects utility.

Consider a general discrete choice model where our outcome Y_i is a discrete choice among J alternatives. U_{ij} denotes the utility of alternative j to individual i and is treated as a set of independent random variables, with a systematic and observable component β_{ij} and a random and unobserved component ϵ_{ij} so that

$$U_{ij} = \beta_{ij} + \epsilon_{ij} \quad (4.1)$$

We assume that individuals will act rationally to maximize their utility, so the probability p_{ij} of individual i choosing alternative j is given by

$$p_{ij} = P(\beta_{ij} + \epsilon_{ij} > \beta_{ik} + \epsilon_{ik}) \quad \forall k \neq j \quad (4.2)$$

To solve this equation, a probability density function must be imposed on the random and unobserved component ϵ_{ij} . The conditional logit model results from assuming that ϵ_{ij} are independent and identically distributed and follow an extreme value distribution function. When this is the case, the probability of individual i choosing alternative j can be rewritten as

$$p_{ij} = \frac{\exp(\beta_{ij})}{\sum_k \exp(\beta_{ik})} \quad (4.3)$$

where the systematic and observed component is defined as $\beta_{ij} = \gamma_j' z_j$. In our case, z_j is the vector of attributes of light bulb alternative j and γ_j is the set of parameters obtained from the model. We will build on this core model of light bulb choice as a function of its three

attributes { price, lifespan, and energy efficiency } to estimate willingness to pay for energy efficiency across sample sub-groups and treatment conditions.

4.5 Results

Table 4.2 displays the results of our core model specification, which models light bulb choice as a function of a triple interaction between bulb attributes, consumer political identity, and the treatment received. Our dependent variable is binary and denotes whether a given light bulb alternative was chosen, such that there are two observations (one 0, one 1) which, when grouped in the model estimation process, together capture the choice outcome of each choice set that a respondent answered. To explore how willingness to pay for energy efficiency (and lifespan, although it is not our focus) varied across political sub-groups depending on which treatment was received, we created a new political ideology variable to divide our sample into liberal, independent, and conservative consumers. Because we are primarily interested in these dynamics at a societal level, we coded this variable broadly: "liberals" denotes respondents who described their political beliefs as "very," "somewhat," or "closer to" liberal, and "conservatives" denotes respondents who described their political beliefs as "very," "somewhat," or "closer to" conservative.

The table reports the results of estimating this model using both the pooled stated and revealed preferences data as well as the revealed preferences data on their own. The "Coefficients" columns report the results of estimating the conditional logit itself, with robust standard errors clustered by individual respondent in parentheses below each parameter estimate. The effects across the two analyses are similar, although all interactions are highly statistically significant in the pooled data while several lose their significance in the smaller revealed preferences study. The "WTP" columns display the willingness to pay point estimates for energy efficiency and lifespan that are implied by each parameter estimate. Willingness to pay for an attribute is measured here as the negative ratio of the estimated coefficient for that attribute to that of price, calculated for a given sub-sample. (The WTP for price itself has no substantive meaning, so these cells of the table are left blank.)

Table 4.2: Conditional Logit Results and Implied WTP for Energy Efficiency and Lifespan

	Stated & revealed preferences		Revealed preferences only	
	Coefficients (Robust SEs)	Implied WTP	Coefficients (Robust SEs)	Implied WTP
Energy Efficiency				
Liberal x Environmentalism	0.742 (0.062)	\$4.28	0.795 (0.130)	\$4.69
Liberal x Savings	0.658 (0.059)	\$2.62	0.766 (0.124)	\$1.83
Liberal x Patriotism	0.860 (0.068)	\$3.08	0.834 (0.151)	\$3.24
Independent x Environmentalism	0.580 (0.059)	\$2.40	0.461 (0.111)	\$5.97
Independent x Savings	0.601 (0.070)	\$2.78	0.704 (0.145)	\$2.91
Independent x Patriotism	0.597 (0.060)	\$2.56	0.679 (0.132)	\$3.47
Conservative x Environmentalism	0.611 (0.054)	\$1.97	0.562 (0.104)	\$2.91
Conservative x Savings	0.673 (0.056)	\$1.80	0.577 (0.109)	\$2.32
Conservative x Patriotism	0.670 (0.053)	\$2.46	0.621 (0.125)	\$2.63
Lifespan				
Liberal x Environmentalism	0.213 (0.037)	\$1.23	0.206 (0.094)	\$1.21
Liberal x Savings	0.214 (0.035)	\$0.85	0.265 (0.088)	\$0.64
Liberal x Patriotism	0.223 (0.043)	\$0.80	0.118 (0.096)	\$0.46
Independent x Environmentalism	0.198 (0.039)	\$0.82	0.067 (0.083)	\$0.87
Independent x Savings	0.205 (0.043)	\$0.95	0.252 (0.111)	\$1.04
Independent x Patriotism	0.227	\$0.97	0.253	\$1.29

	(0.036)		(0.095)	
Conservative x Environmentalism	0.244 (0.032)	\$0:79	0:151 (0.077)	\$0:78
Conservative x Savings	0.277 (0.036)	\$0:74	0:129 (0.083)	\$0:52
Conservative x Patriotism	0.225 (0.032)	\$0:83	0:116 (0.091)	\$0:49

Price

Liberal x Environmentalism	0.173 (0.053)		0:170 (0.118)	
Liberal x Savings	0.251 (0.049)		0:418 (0.103)	
Liberal x Patriotism	0.279 (0.056)		0:257 (0.126)	
Independent x Environmentalism	0.241 (0.051)		0:078 (0.097)	
Independent x Savings	0.216 (0.056)		0:242 (0.132)	
Independent x Patriotism	0.234 (0.052)		0:196 (0.114)	
Conservative x Environmentalism	0.310 (0.043)		0:193 (0.098)	
Conservative x Savings	0.374 (0.047)		.249 (0.101)	
Conservative x Patriotism	0.272 (0.047)		0:236 (0.117)	

Observations	21,540	3,594
Wald chi ² (27)	1328.37	453.20
Prob chi ²	0.000	0.000
Log pseudolikelihood	-5586.62	-880.61
Pseudo R ²	0.252	0.293

Note: Robust SEs were clustered by respondent.

p<0.1; p<0.05; p<0.01

Starting with our baseline expected results, we begin by observing that there is support for the *Liberal Sustainability Bias Hypothesis*: liberal consumers in the pooled data are

more willing to pay for energy efficiency under the control condition than are conservative consumers, and in a Wald-type hypothesis test designed for nonlinear combinations of coefficients like willingness to pay we are able to reject the null that these parameters have the same value ($p < 0.047$). Median WTP for energy efficiency among liberals is -\$2.62 for a \$1 increase in annual energy costs under the control condition, while the equivalent willingness to pay among conservative consumers was only -\$1.80.⁸ These effects appear to reverse in the smaller revealed preferences study, with conservative WTP for energy efficiency estimated at -\$2.32 under the control condition and liberal WTP estimated at only -\$1.83, but these point estimates were not statistically distinguishable in hypothesis tests. This was common in our analyses, so results will be reported with respect to the pooled data from here onward unless otherwise noted.⁹

We also observe strong support for the *Liberal Associative Effect Hypothesis*, which predicted that liberal consumers would be most responsive to the environmentalist messaging and significantly more so than conservatives receiving the same treatment. Median willingness to pay for energy efficiency among liberals was -\$4.28 for a \$1 increase in annual energy costs when the light bulb was marketed to them with an environmentalist message evoking popularly liberal values, compared to only -\$1.97 among conservatives. A Wald-type hypothesis test rejected the null that these parameters were equivalent in value ($p < 0.045$). The liberal point estimate for WTP for energy efficiency is also markedly higher than the estimates under the other two treatments, which were -\$2.62 under the control condition and -\$3.08 under the patriotic messaging treatment, but these estimates were not distinguishable

⁸It should be noted that greater *negative* WTP values indicate greater willingness to pay in this study, because energy efficiency has been defined quantitatively in terms of annual energy costs. Lower costs signify greater efficiency, so a negative willingness to pay for a \$1 increase in energy costs means an aversion to higher energy costs and a willingness to pay to lower them.

⁹There is a robust literature in experimental economics characterizing the risk that stated preference data can overestimate willingness to pay relative to true revealed preference data. However, when we estimate a baseline model containing only the interactions between the light bulb attributes and the three treatments, we found that all interactions are highly significant and that median consumer willingness to pay for energy efficiency appears to be either similar or higher in the revealed preferences data alone relative to either the isolated stated preferences data or the pooled data. For this reason, we feel reasonably confident that reporting the results from the pooled data may actually *underestimate* the true magnitude of consumer willingness to pay in our study, even when we do not observe universally statistically significant effects in the smaller revealed preferences study.

in hypothesis tests. Still, we find that liberals are generally more willing to pay for energy efficiency than conservatives and considerably more so when treated with environmentalist marketing that evokes liberal in-group values.

Our most remarkable finding concerns the evidence we find for the *Conservative Associative Effect Hypothesis*, which hypothesized that conservative consumers would not only be most responsive to the patriotic marketing of energy efficiency but could be induced to exhibit a similar WTP for it as liberals who had been treated with environmentalist messaging. Unlike the propensity for liberal consumers to value sustainability or respond positively to environmentalist marketing, the potential for a conservative reframing of sustainability to increase conservative consumer demand for sustainable products has not been explicitly explored in the literature to our knowledge. We find that median conservative willingness to pay for energy efficiency was indeed highest under this treatment, at -\$2.46 for a \$1 increase in annual energy costs relative to -\$1.80 and -\$1.97 under the control and environmentalist conditions, respectively.¹⁰ Further, whereas liberal consumers were significantly more willing to pay for energy efficiency than conservative consumers under the environmentalist and cost savings marketing treatments, hypothesis tests failed to reject the null that liberal and conservative WTP for energy efficiency were equivalent under the patriotic marketing treatment. Most striking of all, hypothesis tests also failed to reject the null that conservative WTP for energy efficiency under the patriotic marketing treatment was equivalent to liberal WTP for energy efficiency under the environmentalist marketing treatment. When sold energy efficiency using conservative in-group values, it appears that conservative consumers were induced to a level of willingness to pay for energy efficiency that was actually similar to the WTP exhibited by liberal consumers who are appealed to with liberal in-group values.

We find far less support for the *Liberal* and *Conservative Dissociative Effect Hypotheses*, which is noteworthy in its own right. Among both liberal and conservative consumers, the lowest point estimates for median willingness to pay for energy efficiency occurred under the control condition, not under the treatment condition associated with the values of the

¹⁰A hypothesis test rejected the null that conservative WTP for energy efficiency was the same under the patriotic treatment as under the control condition, but only weakly at the $\alpha = 0.1$ level ($p < 0.075$).

political out-group. No statistically discernible negative effects on willingness to pay for energy efficiency relative to the control condition were detected for either liberal or conservative consumers. This is inconsistent with our hypotheses, which predicted a weaker but detectable negative effect on WTP relative to the control under the treatments evoking out-group values. However, this finding is broadly in line with our expectation that dissociative effects should be weaker than their associative counterparts. Our findings are perhaps all the more consistent with the literature in psychology suggesting that in-group favoritism is not only stronger than out-group antipathy, but often wholly independent of it (Brewer 1999; McConnell, Margalit, Malhotra et al. 2018).

Finally, we also found little evidence for the *Cost Savings Dominance Hypothesis*, in which we hypothesized that the control condition selling energy efficiency with pure economic self-interest would be the least politically polarizing and therefore the most compelling of the three treatments to the mass audience. When we estimated the same model as reported in Table 4.2 but without the political ideology-based interactions, the point estimate for median consumer willingness to pay for energy efficiency was lowest among respondents who received this treatment: -\$2.26 relative to -\$2.57 under the environmentalist messaging and -\$2.72 under the patriotic messaging. Hypothesis tests failed to reject the null that these estimated values were equivalent, but the overall weakness of the control condition emphasizing simple cost savings is noteworthy. The similarity of these three willingness to pay estimates absent any interaction with political ideology also underscores the explanatory power of political identity in explaining the choice behavior we have observed here.

4.6 Discussion and Implications

At the broadest level, these investigations suggest that the realm of consumer behavior can be a political space, where political identity shapes choice, economic decision-making constitutes political action, and purchases become manifestations of identity politics. This section will discuss the insights recovered from this field experiment, outlining the theoretical and empirical contributions we have made and raising questions for future research.

In its earliest planning stages, this study was motivated by a desire to understand a puzzle from the existing literature: what was the causal mechanism behind the finding in Gromet, Kunreuther, and Larrick (2013) that conservative consumers bought fewer energy-efficient light bulbs than liberals, but only when they were both more expensive and marketed with environmentalist messaging? We theorized that these factors had made the purchase decision salient as a moral, political choice to the conservative consumers about whether they would incur a cost to support the environmentalist cause. If people derive utility from acting in ways that are consistent with their own in-group's values, this impulse would likely play a role in consumption decisions when the way a product is marketed is perceived as politicized to the consumer. Within this framework, one explanation for the barriers to green products gaining market share was the fact that they were usually *marketed* as good for the environment { a cause that had been very much associated with liberal values in U.S. politics. Perhaps conservative consumers who reject green products may not be dismissing sustainability itself, but rather the politicized messaging embedded in how those products are typically sold to consumers.

The results of this experiment suggest that this framework captures an important part of the explanation for why sustainable consumption can polarize consumers along political lines. The willingness-to-pay-boosting associative effects we hypothesized and found support for among both liberals and conservatives suggest that consumer political identity and product marketing often interact to shape consumption decisions in ways that have more to do with the marketing than the product. From a pragmatic perspective, emphasizing environmental benefits is not the only way to appeal to consumers to embrace sustainability. In fact, it is a strategy that we find is especially well-received by liberal consumers but discernibly less so by conservative consumers. Remarkably, conservative consumers can be induced to a similar level of willingness to pay for energy efficiency simply by marketing it to them in ways that better appeal to their own political in-group values. This insight has practical relevance to the potential for increasingly sophisticated strategies of micro-targeted advertising to eventually play a consequential role in encouraging sustainable consumption on a mass scale.

Equally thought-provoking are the results that did not support our hypotheses. We expected to find evidence that the social dynamics between ideological in-groups and out-groups in a given political setting can have significant unappreciated negative externalities for the common good. Yet we found little robust evidence for the presence of especially strong dissociative effects in which consumers react negatively to marketing that speaks to the values popularly associated with a political out-group. This casts identity politics in a light that is rarely explored in political science but better-known in psychology: there is an apparent asymmetry in the power of associative and dissociative effects, such that the utility of acting consistently with one's political in-group is stronger than or wholly independent of the utility of rejecting affinity with one's political out-group. The implications of this asymmetry for the identity politics of other political spheres is a worthy and potentially optimistic avenue for future research on political behavior.

This observation goes hand in hand with the ostensible weakness of the control condition at boosting willingness to pay for energy efficiency. Consumers of both political persuasions were consistently more willing to pay for energy efficiency after being given a broader purpose to do so { even when that reason spoke to the values popularly associated with a political out-group. Perhaps most politically engaged consumers *prefer* being given a broader reason for a purchase and are more sympathetic to the core values of political out-groups than the modern rhetoric about our high polarized era would have us believe. Perhaps many retailers are misguided to strip their brands of any reference to a cause that could be considered "political" in nature. These are open questions that we hope future research will address. Until then, we hope that these insights can be leveraged for the common good by those who wish to more efficiently promote sustainable consumption on a mass scale in our society.

Table 4.3: Demographics in Representative Sample versus U.S. Population

Demographic category	Representative sample	U.S. population
Age		
18-35	23.60	32.31
36-65	54.00	48.93
Over 65	22.40	18.86
Sex		
Female	51.78	50.8
Male	48.22	49.2
Race		
White	65.04	61.3
African American	11.67	13.3
Hispanic	15.60	17.8
Other	7.69	7.06
Educational attainment		
No degree	10.11	11.7
High school degree	57.59	48.05
Bachelor or higher	32.31	40.24
Region		
Northeast	17.89	17.4
South	37.55	37.9
Midwest	21.15	21.0
West	23.41	23.7

4.7 Appendix

4.7.1 Appendix A: Sample Demographics

Table 4.3 compares the demographics of our representative sample of voting-age U.S. citizens to those of the U.S. population as a whole. All population demographics reported are percentage estimates from the U.S. Census Bureau for the total U.S. population with the

exception of the age and educational attainment estimates, which represent percentages of the U.S. population over the age of 18 to ensure that the sample and population figures for these demographic categories are directly comparable.¹¹

4.7.2 Appendix B: Full Survey Module

The text of our survey module is reproduced below in its original form. Respondents were recruited into the survey by GfK such that three nationally representative sub-samples of approximately 600 respondents each were obtained. These three sub-samples were then assigned one of three survey types (referred to below as A, B, or C) corresponding to our three marketing primes. Survey A marketed the product as "great for the environment," Survey B marketed it as "great savings," and Survey C marketed it as "great for America's energy independence."

Screeners: Have you ever bought or do you ever anticipate buying a light bulb for use in your home?

1. Yes
2. No

If answered "No" or refused, respondent was not included in the sample.

UCLA is conducting this survey to better understand how your attitudes affect the types of products that you buy. At the end of this survey we will be providing you with a cash gift that you can spend on one of several products.

1. Politically, would you describe yourself as liberal, conservative, or neither liberal nor conservative?

¹¹The population-level age data is available online at https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_16_5YR_DP05&src=pt. The sex and race demographics are the figures reported for July 1, 2016, and they are available online at <https://www.census.gov/quickfacts/fact/table/US/PST045216>. The population-level figure reported for White above is listed in the U.S. Census data as "White alone, not Hispanic or Latino," and the population-level figure reported for Hispanic above is listed in the U.S. Census data as "Hispanic or Latino." The population-level figures for educational attainment are those given by the U.S. Census for the population over the age of 18 in 2016 and are available from the "All Races" Excel file available at <https://www.census.gov/data/tables/2016/demo/education-attainment/cps-detailed-tables.html>. The population-level region demographics are the figures given by the U.S. Census data for 2016 and are available online at https://www.census.gov/popclock/data_tables.php?component=growth.

1. Very liberal
2. Somewhat liberal
3. Closer to liberal
4. Neither liberal nor conservative
5. Closer to conservative
6. Somewhat conservative
7. Very conservative

2. When thinking about your current or most recent romantic partner, would you describe them as liberal, conservative, or neither liberal nor conservative?

1. Very liberal
2. Somewhat liberal
3. Closer to liberal
4. Neither liberal nor conservative
5. Closer to conservative
6. Somewhat conservative
7. Very conservative

3. Would you describe [IF SURVEY TYPE = A, caring about what is best for the environment / IF SURVEY TYPE = B, caring about what is the best value for your money / IF SURVEY TYPE = C, caring about what is best for America] as a value that is liberal, conservative, or neither liberal nor conservative?

1. Very liberal
2. Somewhat liberal
3. Closer to liberal
4. Neither liberal nor conservative
5. Closer to conservative
6. Somewhat conservative
7. Very conservative

4. Would you find it attractive, unattractive, or neither attractive nor unattractive to be described by others [IF SURVEY TYPE = A, as someone who protects the environment by reducing climate change / IF SURVEY TYPE = B, as someone who acts frugally by finding the best value for your money / IF SURVEY TYPE = C, as a person who acts patriotically by putting America first]?

1. Very attractive

2. Somewhat attractive
3. Closer to attractive
4. Neither attractive nor unattractive
5. Closer to unattractive
6. Somewhat unattractive
7. Very unattractive

Next we are going to ask you about a household product that you use regularly: light bulbs for use within your home.

5. Do you or does someone else usually purchase the light bulbs for your home?

1. I do
2. Someone else does

6. 60-watt-equivalent warm-white light bulbs are some of the most commonly purchased light bulbs for American homes. Would you be able to use one of these light bulbs for your home?

1. Probably yes
2. Probably no

When buying light bulbs, most people focus on three features. We will present each of these features to you one at a time over the next three screens. We will then present you with some light bulbs to choose from.

The **price** of the light bulb describes how much it will cost you to purchase it. The typical price of a light bulb can vary from \$1.99 to \$4.99 depending on who produces it, how long it lasts, and how energy efficient it is.

Light Bulb Feature	Typical Range
1. Price: How much does it cost you to purchase?	\$1.99 to 4.99

A second feature is the **lifespan** of the light bulb. This describes how many years the light bulb will last before it burns out and needs to be replaced. The lifespan of a light bulb can vary from 1 to 10 years or more depending on its type and quality.

Light Bulb Feature	Typical Range
1. Price: How much does it cost you to purchase?	\$1.99 to 4.99
2. Lifespan: How long will it last in your home?	1 to 10 years

A third feature is the **energy efficiency (or cost of operating) of the light bulb**. This describes how much energy the light bulb uses in a year, which shows up as costs on your electric bill.

Light bulbs with an **Excellent** energy efficiency rating are the cheapest to operate. The energy efficiency of a light bulb can range from \$1.00 in energy costs per year to \$4.80 per year, depending on whether its rating is **Excellent, Good, Fair,** or **Poor**.*

Light Bulb Feature	Typical Range
1. Price: How much does it cost you to purchase?	\$1.99 to 4.99
2. Lifespan: How long will it last in your home?	1 to 10 years
3. Energy Efficiency Rating (and cost to you per year)	Excellent to Poor (\$1.00 to \$4.80 per year)

* This assumes average hours of light bulb use and electricity costs for the typical U.S. household.

Which of these **features** are most important to you? Please rank them in order of importance with 1 being most important and 3 being least important.

Price: How much does it cost you to purchase?	<input type="text"/>
Lifespan: How long will it last in your home?	<input type="text"/>
Energy Efficiency Rating (and cost to you per year)	<input type="text"/>

IF SURVEY TYPE = A:

Energy efficient light bulbs reduce the greenhouse gas emissions that cause climate change. This means the most energy efficient light bulbs are also the best for the environment.

Shortly, you are going to have the opportunity to choose one of several possible light bulbs. The more energy efficient the light bulb you choose is, the better it is for the environment.

Figure 4.5: Treatment A: Selling Energy Efficiency with Environmentalism

LIGHT BULB

Great for the Environment

60w
replacement*
reemplazo
8.5w LED

Soft white light
luz blanca suave

Lasts **10 Years**** | General Purpose

LED

Non-Dimmable		*** See side panel for details	
Brightness/Brillo	Estimated Energy Cost Costo Estimado de Energía	800 lumens/lumens	\$1.02 per year/por año

IF SURVEY TYPE = B

Energy efficient light bulbs save you money by reducing how much you spend on electricity each year. This means the most energy efficient light bulbs are also the best for cost savings.

Shortly, you are going to have the opportunity to choose one of several possible light bulbs. The more energy efficient the light bulb you choose is, the better it is for cost savings.

Figure 4.6: Treatment B (Control Condition): Selling Energy Efficiency with Cost Savings



IF SURVEY TYPE = C

Energy efficient light bulbs reduce America's dependence on the foreign countries that we currently purchase oil and natural gas from. This means the most energy efficient light bulbs are also the best for America's energy independence.

Shortly, you are going to have the opportunity to choose one of several possible light bulbs. The more energy efficient the light bulb you choose is, the better it is for America's energy independence.

Figure 4.7: Treatment C: Selling Energy Efficiency with Patriotism

On the next few screens, we are going to ask you to select a light bulb from two possible choices. At the end of this survey, you will select a light bulb to purchase with your cash gift of \$5. Your purchase options will depend on the light bulbs you select on the next few screens, and the bulb you select to purchase will be mailed to you.

The light bulb pictured above (which you can hover on to enlarge) is the most energy efficient option with the rating of Excellent, but light bulbs can have many combinations of features. If you could purchase one of the following light bulbs, which would you choose?

The first conjoint choice set is displayed, formatted as shown in Figure 4.4.

Figure 4.8: Example of Conjoint Choice Set Formatting

Light Bulb Feature	Bulb 1	Bulb 2
Price: How much does it cost you to purchase?	\$1.99	\$4.99
Lifespan: How long will it last in your home?	10 years	10 years
Energy Efficiency Rating (and cost to you per year)	Fair (\$3.50 per year)	Excellent (\$1.00 per year)
My choice:	<input type="radio"/>	<input type="radio"/>

Let's try another one. If you could purchase one of these light bulbs, which would you choose?

The second conjoint choice set is shown.

Here is another one. If you could purchase one of these light bulbs, which would you choose?

The third conjoint choice set is shown.

Let's do just two more before your actual purchase. If you could purchase one of these light bulbs, which would you choose?

The fourth conjoint choice set is shown.

If you could purchase one of these light bulbs, which would you choose?

The fifth conjoint choice set is shown.

We are now going to give you your \$5 credit to purchase one of the light bulbs described below. Please select the light bulb you would like to purchase. After you complete this survey, this light bulb will be mailed to you. Any money left over will be yours to keep and credited to your KnowledgePanel account.

Which of the following light bulbs would you like to purchase?

The sixth and final conjoint choice set is shown.

When making your light bulb purchase decision, would you say that the following considerations were important, unimportant, or neither important nor unimportant in your decision-making?

The order of following sub-questions was randomized.

Whether the purchase was good for...

... protecting the environment by reducing climate change?

1. Very important
2. Somewhat important
3. Closer to important
4. Neither important nor unimportant
5. Closer to unimportant
6. Somewhat unimportant
7. Very unimportant

... acting frugally by finding the best value for your money?

1. Very important
2. Somewhat important
3. Closer to important
4. Neither important nor unimportant
5. Closer to unimportant
6. Somewhat unimportant
7. Very unimportant

... acting patriotically by putting American energy independence first?

1. Very important
2. Somewhat important
3. Closer to important
4. Neither important nor unimportant
5. Closer to unimportant
6. Somewhat unimportant
7. Very unimportant

When it comes to the Trump Administration, would you describe yourself as supportive, opposed, or neither supportive nor opposed?

1. Somewhat supportive
2. Closer to supportive
3. Neither supportive nor opposed
4. Closer to opposed
5. Somewhat opposed
6. Very opposed

NOTE: GfK made an error in the programming of this question that removed the "Very supportive" category that should have been listed above "Somewhat supportive."

CHAPTER 5

Concluding Remarks

At the heart of this dissertation is an idea and an argument. The idea, which animates the three intellectual projects collected in this volume, is that there is a way to measure, communicate, and address climate pollution not as a problem of production, but as a problem of consumption. This much is uncontroversial, if not popular. The argument is more radical. It is that much of our canonical understanding of climate politics { as an issue fraught by international gridlock, domestic sticker shock, and consumer indifference { could itself be transformed by *reframing and studying* climate pollution as a problem of consumption.

In Chapter 2, I considered the implications of consumption-based emissions for international climate politics. I showed that as countries grow wealthier, wealth tends to drive emissions per capita via consumption channels far more than via production channels. Environmental economists have long debated which pollutants peak and decline with growing economic development and which appear to exhibit monotonic upward growth. My models predict that while production-based emissions tend to peak and taper with increasing wealth, consumption-based emissions clearly peak at a much higher level of pollution and may actually continue to increase if our income data is too sparse after the inflection points to inform generalizable predictions. This pattern is problematic when all climate treaties to date have measured emissions responsibility in production terms.

The resulting dynamic { in which international treaties have attempted to regulate the supply of emissions without addressing the demand driving it { has had three perverse effects on international relations on this issue. First, it has enabled the developed world to appear to comply with treaties regulating production while obscuring the role its consumers play in not only driving global emissions but doing so through the production of emissions in

developing world manufacturing centers, making it harder for them to comply with the same treaties. Second, it has emboldened developed world leaders in making ostensibly compelling, fairness-based excuses for abdicating U.S. leadership on this issue because enough is not being asked of the "major emitters" of the developing world. Finally, it has created perverse incentives to free ride on the efforts of other states, in part because compliance with reducing production does not incentivize collaboration with any other specific accountability partners. I argued in this paper that these dynamics are not inevitable. Reframing global emissions as a consumption problem in international climate treaties { which political scientists could help to do { could change our understanding of the politics of this issue dramatically, restructuring incentives to comply in less gridlock-prone ways and reducing the ability of opportunistic elites to credibly claim that developed world leadership on the issue is unfair.

In Chapter 3, my essay with Robert Trager, we made a different argument regarding fairness: that framing developed world responsibility for climate pollution in consumption terms increases the perceived fairness of even a costly international climate agreement among U.S. voting-age adults, and this was a much stronger determinant of approval than cost. This finding, which we derived from a large-N survey experiment, turned on its head the conventional wisdom in political science that cost concerns are a defining driver of { and, indeed, barrier to { domestic support for U.S. involvement in costly global environmental policies. To the contrary, we found evidence that this aversion to the cost of mitigating climate change is at least in part conditional on the perception that the burden is unfair. Reframing pollution in consumption terms increases perceived fairness, and with it increases agreement approval. We also found that the domestic public was more likely to approve of an agreement when told it has bipartisan support and when given information on the estimated future cost of allowing climate change to proceed unchecked. This latter point further underscored the notion that framing effects { or, more appropriately, *reframing* effects, wielded well { could play a powerful role in driving greater public support for climate policy.

In Chapter 4, my essay on an experiment conducted with J.R. DeShazo and Tamara Sheldon, I proposed that sustainable consumption choices can be understood as manifestations of identity politics, and a better understanding of these dynamics could inform better

consumer-level interventions to increase mass willingness to pay for more sustainable, lower-impact products in the marketplace. This essay strove to make a meaningful contribution to our understanding of how political identity shapes consumer behavior, but it was also pragmatic. If developed world consumption is such a major driver of global emissions pollution, can we as political scientists help inform better consumer-level interventions to encourage lower-impact consumption practices?

To this end, we developed a theory of how certain purchase decisions become salient to consumers as moral choices when the marketing of a product attaches a broader purpose to its purchase. When the consumer perceives that broader cause as political in nature { that is, as popularly associated with the values of a particular political ideological group, as sustainability is with U.S. liberals { we suspected that this would cause the consumer's political identity to become salient in considering the purchase. In these settings, we expected that the consumer's choice whether to purchase the product could be understood as the result of an interaction effect between his or her political identity and the product's marketing: when the broader cause is popularly associated with the values of the consumer's political in-group, an *associative effect* would increase willingness to pay for the product; we expected a negative *dissociative effect* otherwise.

In the context of sustainable consumption, we believed that these dynamics were one key reason why green products have been slow to gain market share. Sustainable products are usually marketed as such, but sustainability has been politicized as a liberal cause in the U.S. political context. In a large-N field experiment, we showed that while liberal consumers are generally more willing to pay for energy efficiency and especially so when it is marketed with environmentalism, conservative consumers could be induced to a similar willingness to pay when an energy-efficient product was marketed to them as "good for America's energy independence" instead, a cause that more closely reflects conservative values. This finding flew in the face of the conventional wisdom that "selling sustainability" could not work { it matters how you sell it, and the reason it matters is political in nature. Understanding this interplay of politics and consumption could improve mass efforts to encourage more sustainable consumer demand in our society.

An impressive, although still very much maturing, literature in political science has informed our scholarly understanding of climate politics, but rigorous work on the political economy of consumption-driven climate pollution is in its infancy. Until very recently, data limitations due to the challenges of even estimating national consumption-based emissions made analyses of the sort conducted in Chapter 2 all but impossible, and the conclusions that are challenged in Chapters 3 and 4 about the determinants of domestic support for climate policy and consumer indifference to green products, respectively, were gospel. These three essays have endeavored to show that using the lens of consumption to reframe the issue of climate change could give rise to a more functional politics of climate change, informing efforts at the international, domestic, and individual levels. As Robert Keohane observed in his 2014 James Madison Lecture, "the political economy of policies to respond to climate change varies greatly depending on the policies proposed," with each of them generating "a distinctive type of politics." He concluded, "thinking about climate change *as political scientists* could help shape better decisions about policy."¹ As a collection, these essays represent an attempt to answer this call to action in a way that "habitually connects the pursuit of knowledge with the search for the social good."²

¹This is the original emphasis in Keohane (2015).

²Richard H. Brodhead, "More Day to Dawn: Inaugural Address of Richard H. Brodhead, Ninth President of Duke University," 18 September 2004.

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