The Influence of Business Interest Groups in Urban Policymaking: An Empirical Exploration of a Low Salience Policy Setting

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Abstract

The lack of a national comprehensive climate change policy in the United States has prompted cities to take the lead on urban sustainability actions. Extent research has explored various political, socio-economic and institutional factors to explain why some cities pursue sustainability actions and others do not. The role of organized interest groups – particularly business interest groups – is unclear as to whether their involvement correlates with more or less likelihood of sustainability policy adoption. The pluralist nature of the American political system suggests that various organized interests compete to advance their policy positions, and business interest groups have generally been theorized as economically rational profit-maximizers who would presumably oppose environmental regulation. The overall rise in environmental awareness (Yale University and George Mason University, 2017) raises the possibility that business interest groups will support urban sustainability policies, as firm can be profitable while also limiting environmental impacts.

This dissertation explores how various types of business interest groups effect the adoption of select urban sustainability policies that regulate the environmental impacts of buildings. My rationale for studying buildings is that urban sustainability is too broad of a concept to get at the nuances of interest group activity occurring in each sector, and distinctive business interest groups participate in urban policy processes depending on what sector is being regulated as many firms only work in one sector (e.g., buildings, transportation, water). Further, urban sustainability research commonly operationalizes business interest groups as one group which assumes a singular profit interest, but not all businesses respond to urban sustainability in the same way. I segment the business interest groups in an attempt to measure the effects of distinctive organized interests within a single industry – the construction industry. I generate

sector-specific business interest group data rather than relying on survey data or general proxies for business interests which are more common approaches in urban sustainability research. This work overcomes the issue with obtaining business interest group data in cities by using an algorithmic approach to data collection using the Python programming language for text mining industry association websites and member directories.

Using various regression methods, my findings suggest that this approach to operationalizing interest groups has merit. The segmented business interest groups have divergent effects on the energy efficiency and green building policies with traditional construction interest groups having a negative effect on policy adoption while 'green' construction groups have a positive effect (Chapter 3 and Chapter 4). In Chapter 5, I explore the effects of organized interests on reported energy savings in published studies using a regression-based meta-analysis approach. My results suggest that organized interests have an effect on reported energy savings, supporting a theory of advocacy bias in information sharing.

On a theoretical level, this research contributes to understanding business interest groups in local urban policymaking in a low salience policy setting. It provides the insight that some segments of business interest groups are likely to have a positive effect on urban sustainability and environmental policy adoption while other segments are likely to have a negative effect, so it is important to segment business interest groups rather than treating them as one group with the same motivations. Also regarding theory, this work supposes that the buildings policy domain is low salience but it does attract political participants, albeit a narrowly focused group of technical professionals, which is divergent from some extent literature that suggests that low salience policy issues do not attract interest groups. Considering other urban sustainability sectors as low salience may be appropriate, as other areas may also attract groups of technical experts more so than citizen groups. Methodologically, this research promotes algorithmic data collection as a way to overcome difficulties in collecting city-level data.

Table of Contents

Chapter 1 Introduction and Study Overview ... 1
    Operationalizing Business Interest Groups in Urban Policy Research ... 2
    Environmental Impacts of Buildings as a Low Salience Policy Issue ... 3
    Research Roadmap ... 5
    Works Cited in This Section ... 8
Chapter 2 Review of Literature on Business Interest Groups and Urban Sustainability Policy ... 10
    Openness of the American Political System ... 10
    Urban Sustainability Policy and Business Interest Groups ... 13
    Research Gaps ... 16
    Works Cited in This Section ... 19
Chapter 3 Segmenting the Construction Industry: A Quantitative Study of Business Interest Groups in a Low Salience Policy Setting ... 22
    Introduction ... 22
    Theory and Hypotheses ... 25
    Background on Building Energy Codes ... 31
    Research Design ... 34
    Data Analysis and Discussion ... 40
    Conclusion ... 46
    Tables and Figures ... 48
    Works Cited in This Section ... 54
Chapter 4 How Business Interest Groups Matter: Rare Events Modeling of Green Building Policy Adoption in Cities ... 59
    Introduction ... 59
    Theory and Hypotheses ... 61
    Background on the LEED Program ... 67
    Research Design ... 68
    Rare Events Logit Model and Discussion on Modeling Results ... 73
    Conclusion ... 78
    Tables and Figures ... 80
    Works Cited in This Section ... 86
Chapter 5 Interest Groups, Policy Impacts, and Advocacy Biases ... 90
    Introduction ... 90
    Theory and Hypotheses ... 93
    Background on the LEED program ... 98
    Research Design ... 99
    Data Analysis ... 106
    Meta-regression Modelling Results ... 108
    Discussion and Conclusion ... 112
    Tables and Figures ... 114
    Works Cited in This Section ... 125
    Appendix ... 130
Chapter 6 Conclusion and Lessons Learned ... 133

List of Tables

Table 3-1. Expected Direction of Coefficients in the Energy Code Adoption Model................. 48

Table 3-2. Most Recently Adopted Energy Code in Cities within Home Rule States 49

Table 3-3. Variables, Descriptions, and Data Sources for Energy Codes Model......................... 50

Table 3-4. Descriptive Statistics for Energy Codes Model.. 51

Table 3-5. Logistic Regression Results from Modeling Energy Code Adoption......................... 52

Table 3-6. Odds Ratios for Energy Code Adoption... 53

Table 4-1. Variables, Descriptions, and Data Sources for Green Building Models..................... 81

Table 4-2. Descriptive Statistics for Green Building Policy Adoption Models 82

Table 4-3. Rare Events Logit Results from Modeling Green Building Policy Adoption............ 83

Table 4-4. Odds Ratios for Green Building Policy Adoption Models... 84

Table 5-1. Hypotheses 114

Table 5-2. Articles Retrieved by Database 115

Table 5-3. Studies Used in this Analysis 116

Table 5-4. Variables and Descriptions... 117

Table 5-5. Descriptive Statistics 118

Table 5-6. Paired T-test of Site Energy Use Intensity for LEED and Baseline Buildings 119

Table 5-7. Meta-regression Model... 123

Table 5-8. 22 Studies Included in Meta-Regression Models... 131

List of Figures

Figure 4-1. Count of LEED Certification Policies in this Study (n = 277 cities) 80

Figure 4-2. Marginal Effects of Interest Groups on Predicted Policy Adoption 85

Figure 5-1. Box plot of Energy Use Intensity for LEED and Baseline Buildings (n=164) 120

Figure 5-2. Box Plot of Energy Use Intensity by Building Type (n=164) 121

Figure 5-3. Scatterplot of Energy Use Intensity by Number of Buildings (n=164) 122

Figure 5-4. Reported Energy Use by Primary Author Affiliation 124

Chapter 1 Introduction and Study Overview

Over the past few decades, local governments, businesses and citizen groups have been embracing urban sustainability as a fundamental concern, working towards alleviating some of the environmental pressures caused by urban activity, such as energy consumption and air pollution. In addition to addressing local environmental problems, American cities have immense opportunity to lessen the climate change problem globally as the United States is the second largest emitter of greenhouse gas emissions worldwide (US Environmental Protection Agency, 2017). Given the lack of a comprehensive national climate policy in the United States, cities have taken the lead on climate change mitigation through local sustainability policy adoption as well as promoting voluntary action among its business and citizens (Daley, Sharp and Bae, 2013; Krause, 2011; Sharp, Daley and Lynch, 2011). Since interest groups are an important part of the American political system (Dahl, 1961; Schumaker, 2013), their involvement in urban sustainability policy processes is expected to influence policy outcomes, such as the types of policies that are ultimately adopted in cities (Berry and Portney, 2013, 2014; Feiock, Portney, Bae, and Berry, 2014).

While the openness of the political system enabling participation from groups with diverse interests is generally considered to be a positive characteristic of democracy, a perpetual threat is profit-seeking interest groups dominating over public interests (Berry, 1999; Kamieniecki, 2006; Kraft and Kamieniecki, 2007; Tocqueville, 1998). The overall rise in environmental awareness (Yale University and George Mason University, 2017) calls into question the likelihood for business interest groups to support public policies that protect public goods such as clean air and water, as the ability for a firm to be profitable and do so in a way that minimizes impacts on the environment is possible (Portney, 2013; Prakash, 2000, Press and

Mazmanian, 2006). Not all businesses will pursue the path of environmental responsibility, so examining the effects of business interest groups on environmental policy necessitates the ability to segment business interest groups according to their distinctive motivations.

Operationalizing Business Interest Groups in Urban Policy Research

Throughout this research I explore the effects of two types of organized interest groups – traditional construction industry representatives and ‘green’ business professionals - on policy processes. The traditional building association is associated with the desire for urban development and city growth for profit gains (Logan and Molotch, 1988; Molotch, 1976), supported by the classical economic viewpoint of firms’ profit maximization objectives (Coase, 1937) and political economic theory of firms as political coalitions colluding to resolve political conflicts (March, 1962). From the perspective of interest group pluralism, competition among firms within the same industry is probable. Some industrial groups are expected to oppose environmental regulation due to concentrated costs and diffuse benefits for group members but environmental interests are expected to be deliberated by policymakers in a pluralist setting (Scruggs, 2003). Fundamentally, both ‘green’ and traditional construction industry members seek profits in the construction industry. A core difference in the conceptualization of the two groups is that traditional construction industry members have more interest in enhancing “profits by 'externalizing' environmental impacts" (Morrison and Roht-Arriaza, cited in Schindler, 2010, p. 329) whereas ‘green’ construction industry members intentionally seek to limit negative externalities, and may even ‘internalize’ some costs associated with the protection of public goods.

Segmenting business interest groups within a single economic or industrial category at the city level has been difficult due to limited data sources that are consistent across cities, a prerequisite for quantitative analysis. Consequently, urban policy scholars have resorted to either creating proxies for business interest group presence, such as counts of manufacturing establishments, or administering surveys for data collection. Given the rough approximation of the former approach and relatively low response rates in the latter approach, I take an algorithmic approach to data collection using member directories for industry associations to construct a dataset of counts of interest group members per city. An issue with the typical measurement approaches is the tendency to treat business interest groups as homogeneous when, in fact, business interests within a city can vary dramatically. To explore this variation within an interest group, I select distinctive industry associations within the construction industry.

Environmental Impacts of Buildings as a Low Salience Policy Issue

My choice to examine the construction industry is motivated by an interest in low salience policy issues to capture the technical nature of many urban sustainability policy areas. Nonetheless, this is an important policy area as major financial gains are at stake given that construction and real estate industries account for over 15 percent of the U.S. gross domestic product (U.S. Bureau of Economic Analysis, 2017). Low salience policy areas are typically characterized by low levels of public attention, instead attracting the engagement of technical experts. The extent to which insights from extent interest group scholarship – which is mostly national in scope and focuses on high salience issues – applies to a technical urban policy issue is unknown. How firms gather into interest groups to gain profit maximization or assemble to support public interests may depend on issue salience.

On an applied level, this research adds depth to the collective understanding of the types of groups that are participating in urban sustainability policy processes while analyzing organized interest groups in a highly technical sector of urban sustainability - *buildings*.[1] Buildings account for 12 percent of the U.S. greenhouse gas emissions portfolio (US Environmental Protection Agency, 2017) and 40 percent of demand-side energy consumption (U.S. Energy Information Administration, 2017).[2] Building energy codes and green building programs are two of the most common public policies that regulate buildings and their components (Erickson, Lazarus, Chandler and Schultz, 2013), thus are focal policies for this research. To date, sustainability research has ordinarily examined policy activity in an aggregate fashion, grouping initiatives from multiple sectors together to better understand why some governments pursue sustainability, and others do not. While this provides valuable insight, as the field of inquiry grows, it is important to more deeply explore specific sectors to better understand decision-making. The actor groups that are responsible for many aspects of the policy processes are overlooked because they are sector-specific (Koski, 2010). This research adds a building block to sectoral research intended to be nested within broader sustainability research. Building codes and green building programs in particular hold considerable promise for reducing greenhouse gas emissions, and yet, the politics and interest group mobilization is understudied. The importance of the public policy domain governing the built environment is

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[1] In 1980, the U.S. had approximately 3.8 million commercial buildings while the most recent estimate in 2012 reported 5.6 million commercial buildings (U.S. Energy Information Administration, 2015, 2017). Similarly, in 1980 the U.S. had only 88 million housing units, growing to over 135 million housing units in 2016 (U.S. Census Bureau, 1990, p. 6; 2017).
[2] Many researchers mispresent the impact of the built environment, portraying that transportation is responsible for over 30 percent of the impact, residential and commercial buildings at less than 20 percent, and electricity at over 30 percent. Actually, a portion of the electricity pie piece is attributed to electric demand from buildings. The residential/commercial distinction only captures end use fuel, such as natural gas, oil, wood and propane.

evident given the financial gains at stake and need to regulate environmental impacts from construction.

Research Roadmap

This dissertation examines the power of interest groups in driving green and energy efficient building in cities as mechanisms to achieve their sustainability goals. In Chapter 2, I explore the core tenets of interest group scholarship and urban sustainability policy context as it relates to the buildings policy domain. In Chapters 3, 4, and 5, I present three empirical studies that ask multiple interrelated questions to explore interest group theories within the paradigm of policy adoption research and the role of interest groups in shaping information about policy effectiveness. The following research questions are explored across the three empirical chapters:

- How do organized interest groups affect sustainability policy adoption when the policy option *imposes concentrated costs* to businesses? Specifically, what are the effects of traditional and 'green' industry member associations on policy adoption for green and energy efficient *privately-owned* buildings?
- How do organized interest groups affect policy adoption when the policy *enables concentrated benefits and diffused costs* to businesses? Specifically, what are the effects of traditional and 'green' industry member associations on mandates for energy efficient, *publicly-owned* buildings?
- Is there an advocacy bias in green building energy consumption analysis?

The first empirical chapter, "Segmenting the Construction Industry: A Quantitative Study of Business Interest Groups in a Low Salience Policy Setting", explores a low salience policy issue to examine the influence of distinct segments of business interest groups on local policy decisions. I analyze the effects of two types of organized interest groups – traditional construction and green building association members - on the adoption of building energy codes, the policies that govern the energy efficiency of buildings. I use logistic regression modeling to estimate the probability of code stringency given differences in the presence of trade association members in cities while controlling for demographic, social, and political factors. I find that the traditional building interest group has a negative effect on the odds of a city's energy code adoption compared to the positive effects of the green builder interest group.

The second empirical chapter, "How Business Interest Groups Matter: Rare Events Modeling of Green Building Policy Adoption in Cities", examines a specific type of business interest group – construction industry associations - involved in the green building policy arena to understand their effects on policy adoptions. Using rare events logit modeling, I estimate the effects of 'traditional' and 'green' industry associations on green building policy adoption while controlling for political, socio-economic and problem severity characteristics of cities. The results indicate that, not surprisingly, the presence of green industry association members increase the likelihood of local policy adoption. However, the traditional industry associations do not limit the probability of green building policy adoption as expected.

The third empirical chapter, "Interest Groups, Policy Impacts, and Advocacy Biases", investigates the information that is published by organized interests in the context of the green building program, Leadership in Energy and Environmental Design (LEED). I test two competing hypotheses – advocacy bias and interest group professionalism – to identify if there is systematic variation across published studies on energy savings from LEED-certified buildings. Using a meta-regression methodology, I find that studies that have an environmental organization as the primary author are likely to report higher levels of energy savings from LEED buildings when compared to studies that have government agencies or universities as the primary author.

Across the three studies, I find that organized interest groups have a significant effect on local sustainability policy adoption. The effect varies depending on the relevance of the interest group to the specific policy. Segmenting the construction industry into 'traditional' and 'green' categories and testing two different case selections – building energy codes and LEED green building standards – helps to affirm the importance of considering nuances of the business interest group and policy type. For example, traditional builder interest groups are highly influenced by building energy code policies, as these policies set the minimum standards for construction. Green builder interest groups are likely to be less affected by building energy codes, as presumably they are already building to higher construction standards. The green builder interest group is heavily intertwined with green building policy adoptions, as these policy advancements could secure more of the construction market for their members. The traditional builder interest group is less concerned with green building policy adoptions, as these policies are commonly for public buildings only or adopted on a voluntary basis. The traditional builders do not have to participate in the green building market as long as green building standards do not become minimum requirements for all construction. These interest group dynamics are also observed when it comes to measuring energy impacts from the LEED program. Organized interests tend to present information that supports their policy positions.

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Chapter 2 Review of Literature on Business Interest Groups and Urban Sustainability Policy

The American political system is relatively open to interest group influences compared to many other governments around the world (Scruggs, 2003; Tocqueville, 1998). This is generally considered a normatively positive characteristic of a democratic government, yet not without potential issues such as capture by corporate interests and other elite (Mills, 1956). The effects that business interest groups have on urban sustainability policy adoption at the local level is unclear, as some studies discover that business interest groups have positive effects on policy adoption while the economic theory of rationality and profit maximization of firms suggests that business interest groups will oppose regulation, particularly regulation that has cost burdens to industry (Kamieniecki, 2006; Kraft and Kamieniecki, 2007). This chapter explores these theoretical foundations and applicability to urban sustainability policy.

Openness of the American Political System

Scholars have been negotiating boundaries for the subfield of interest group scholarship within political science and policy studies. Emphases of various aspects of interest groups – such as group politics, structure, membership, internal group dynamics, strategies and roles in the policy process and political system at large – are found within the sprawling collections of works on interest groups in America. A few dominant lines of inquiry are apparent, including multiple generations of research testing theories of pluralism, or the idea that citizens assemble into groups to pressure policymakers to pursue their democratic ideals in competition with other prevailing interest groups (Dahl, 1961). Challenges to pure pluralist theories include 'biased pluralism,' such as elite (Mills, 1956) and regime theories (Stone, 1989) that explain how affluent citizens or business leaders effectively sway political processes, and 'majoritarian pluralism' (e.g., median voter theory, Downs, 1957) that emphasizes the influence of the electorate (popular vote) (Gilens and Page, 2014). Pluralism, in its purest sense, conceptualizes group participation in the political system as having a normatively positive effect on society, since participation is characteristic of an open and responsive democratic government (Berry, 1999; Kamieniecki, 2006). This is contrary to concerns of tyranny of the majority, which asserts that people must be controlled so that they do not overpower government or less powerful citizens (Madison, 1787). Generally, groups organize around certain issue areas that affect them or affect something that they are ideologically interested in (Lowi, 1979).

Another school of thought on the political participation of interest groups is neocorporatism. Neocorporatism is a structural theory of political participation whereby businesses and governments have a strong relationship absent the influence of public interest groups (Kraft and Kamieniecki, 2007; Scruggs, 2003). Compared to the pluralist school of thought, neocorporatism suggests a more subservient role of businesses to government, with governments in the top hierarchal position. While pluralism is thought to be more explicable of interest group activity in the United States, neocorporatist theory contributes to the understanding of consensual activities between governments and businesses, such as technical guidance provided by business experts for policy issues (Fiorino, 2011, p. 379).

Despite the longstanding collection of interest group scholarship, some outstanding questions, methodological issues, and clarifications have been articulated by contemporary scholars, including the lack of an overarching framework or set of theories for interest groups (Baumgartner and Leech, 1998; Berry, Portney, Liss, and Simoncelli, 2006); exploring the alignment between national, state, and urban interest group theories (Berry, 2010; Berry et al., 2006; Berry and Portney, 2014; Maisel and Berry, 2012); and methodologically, how to identify interest groups, their resources, strategies, and effects on policy processes (Berry et al., 2006; Kraft and Kamieniecki, 2007, p. 24).

As a field of study, interest group research throughout the 20th century consistently asked a common central question still being asked today: to what extent is the policymaking process shaped and controlled by elites, other organized interest groups, and average citizens? Credited with major advancements in mid 20th century research Dahl (1961), while examining public education, urban redevelopment and political party nominations, finds broader patterns of political participation than wealthy power elites as Mills (1956) had suggested. While Dahl's perspective provides an optimistic outlook on American democracy, other scholars emphasize the power of big business that overshadows representation of citizen's values in the democratic process (e.g., Lowi, 1979; Schattschneider, 1975; Stone, 1989). Further, many citizen's interests remain unorganized and unrepresented, never having the chance to reach a policy agenda (Olson, 1965; Schattschneider, 1975). This debate on who gets involved and what effect participation has on policy processes is an eternal concern in interest group scholarship. Currently, much of the interest group scholarship explores nuances of organized interests specific to the level of government from national to state to regional to local (Berry, 2010; Portney and Berry, 2016) in particular issue areas or sectors such as public health or environmental issues (Ball, 2012; Berry and Portney, 2013; Prakash, 2000) and in the context of assorted political, institutional, and economic factors (Gillens and Page, 2014). While extent research has been building towards greater clarity on interest groups, modern-day circumstances call for a more nuanced understanding of interest group dynamics and even challenges to old ways of thinking.

The various approaches to interest group studies reflect discernable differences in *definitions* of the unit of analysis. That is, while individual researchers study 'groups', their definition of group may be incongruous. Baumgartner and Leech (1998) capture the assortment of units of analyses in interest group research:

> "All in all, one can note at least the following types of definitions [of interest groups] used by various scholars interested in the roles of interest groups in politics: social or demographic categories of the population, membership organizations, any set of individuals with similar beliefs, identifications, or interests; social movements; lobbyists registered in legislatures; political action committees; participants in rule-making or legislative hearings; institutions, including corporations and government agencies; coalitions of organizations and institutions; prominent individuals acting as political entrepreneurs or lobbyists. The diversity of definitions represents and underlying diversity of theoretical concerns" (p. 29).

Overall, "some defining characteristics of interest groups include interacting with and/or attempting to influence government" (Baumgartner and Leech, 1998, p. 24-25). This definition is almost identical to the one adopted by Berry and Wilcox (2009): "On the simplest level, when we speak of an interest group, we are referring to an organization that tries to influence government" (p. 5). This dissertation adopts the following definition of interest group: a membership organization that attempts to influence government.

Urban Sustainability Policy and Business Interest Groups

Green and energy efficient building policies are types of policy tools that facilitate the implementation of urban sustainability goals (May and Koski, 2007). Because these policies directly impact major industries, construction and real estate industry representatives actively engage in policy processes that regulate buildings and land development (Feiock, Portney, Bae, and Berry, 2014). While business engagement is predicted to lead to positive policy outcomes in some cases (Wang, Hawkins, and Lebredo, 2012) such as goal-setting and mandates for public facilities, interest groups remain divided on many aspects of sustainability, including building code advancement that inherently imposes cost burdens on the construction industry.

Indeed, the construction industry and citizens alike generally support cost-efficient urban growth for personal gain and improved quality of life (Molotch, 1976; Feoick et al., 2014), as people want to live near environmental amenities such as beach fronts even though location choice may not be in the public interest from an environmental and economic perspective (Lubell, Feiock, and De La Cruz, 2009). From this viewpoint, builders are simply fulfilling buyer demand while maximizing their profits in line with the “sustainability paradox,” which posits that wealthier communities may be more environmentally conscious but also demand more and larger homes that inherently use more natural resources (Lubell et al., 2009).

Because some businesses have specialized in ‘green’ development particularly in select urban markets, research in this area has highlighted business support in environmental policy processes (e.g., May and Koski, 2007; Portney and Berry, 2016). Some contemporary neopluralists emphasize that individuals participate in policy processes because they are driven by ideology and not simply motivated by costs and benefits (Berry et al., 2006; Schumaker, 2013). However, those industry members who appear to be ideologically motivated may be acting strategically to be successful in a distinctive market segment. The optimistic perspective that the construction industry has been ‘greened’ is challenged by the idea that industry members may be seeking market differentiation; these industry members may not necessarily be motivated by ideological commitments to environmental sustainability, but rather rent and sales premiums from green building (Gripne, Martel, and Lewandowski, 2012). The construction industry has been criticized for “greenwashing”, or promoting a symbolic image that supports environmental ideals, but with questionable substantive actions to this end (Prakash, 2000; Press and Mazmanian, 2006; Robbins, 2001). Further, more traditional business members who are agnostic about green development ideals are still actively engaged in local policy processes and likely have a strong effect in most urban markets. Exploring this complex situation can reveal insights into the ways in which industry-oriented interest groups influence energy efficient building and land use development.

In a separate line of inquiry, Koski (2010) characterizes green building as a low salience policy issue that is technical, complex, and does not engage a myriad of interest groups. Koski suggests that “knowledge brokers” who translate complex technical information between experts and policymakers are more commonly active in low salience policy areas than interest groups. However, these knowledge brokers have “a specific interest in seeing a policy prevail” (p. 97) and “Knowledge brokers can engage in tasks akin to more traditional interest groups as champions for specific policy solutions” (p. 97), which creates some fuzziness between the definition boundaries of knowledge brokers and interest group members. In theorizing about differences in national and local interest groups, Berry and Portney (2014) argue that low levels of regulation compared to national levels make it so business interest groups are relatively inactive, except, they note, in the areas of land use where “developers, construction firms, and business trade councils” mobilize (p. 27). Indeed, some urban sustainability and climate change policy areas are technical and complex, engaging only a few interest groups in the policy processes relative to other high salience policy areas. Further, the interest groups often have a professional representative who represents the organization’s (and member’s) policy positions collectively. It would be remiss to think that interest groups are not active in urban sustainability policy processes because of their low salience because indeed, interest group presence is observed in green building and energy code policy processes, albeit highly technical and professional.

Research Gaps

The effects of business interest groups on urban sustainability policy adoption remains unclear (Berry and Portney, 2013; Feiock, Portney, Bae, and Berry, 2014; Kamiencki, 2006; Kraft and Kamiencki, 2007; Potoski and Woods 2002; Prakash, 2000). Some studies conclude that business interest groups have effects on policy processes (e.g., Jenner et al., 2012) while other studies find no statistically significant effect (e.g., Berry and Portney, 2013; Deslatte and Swann, 2016). The discrepancies could be partially attributed to the aforementioned issues, such as different ways that researchers operationalize interest group presence, level of analysis of the study, or policy area.

For example, Berry and Portney (2013, 2015) found that the inclusion of business groups in deliberations had no statistically significant effect on policy adoption but environmental group involvement did have an effect in both studies. Similarly, in a study on a mix of energy policy tools, Deslatte and Swann (2016) found that neither environmental groups nor developers had a statistically significant effect on selecting energy policy tool bundles, but when modeling single policy tools for green construction and land use, environmental groups had statistical significance while developers did not. Business interest groups are expected to matter to urban policy adoption, so more research is needed to understand what explains the variation of effects across studies.

In general, contemporary urban policy processes tend to be more cooperative than conflicted, especially issues with low salience that are highly technical and complex such as green building and building energy policies (Gormley, 1986; Koski, 2010). In such situations, organized groups negotiate and bargain among the group of technical experts, often approaching policymakers with a cohesive proposal developed through a stakeholder engagement process facilitated by government staff or non-governmental organizations (Berry, 2010; May and Koski, 2007; Schumaker, 2013). This may cause policy preferences of oppositional interest groups to appear convergent, which may mispresent the effect size of interest groups.[3]

Contributing to the set of theories for interest groups, this research explores the impact of divergent interest groups on local government decision making, particularly when interest groups within the same business category diverge on policy issues despite facing similar potential costs and benefits. I explore the interplay between motivations by ideology and profit. Indeed, multiple scholars have recognized the need to categorize differences between actors within business groups – such as traditional and 'green' construction industry actors – to gain a better understanding of interest groups effects on policy processes (e.g., Portney, 2009; Sharp, Daley, and Lynch, 2011, p. 438).

This approach was pursued by Jenner, Chan, Frankenberger, and Gabel (2012) who did not only study the effects of industry-oriented interest groups on renewable energy policies, but also separated the industry interest groups into sustainability-oriented solar energy association members and conventional energy utility association members. Jenner et al. (2012) found the effects of sustainability-oriented interest group to be 1.33-3.77 in relative odds of Renewable Portfolio Standards policy adoption and the conventional energy utility interest group ranging from -0.24 - 0.67 in relative odds. These results suggest that significant differences can be found when separating industry groups into more nuanced categories. This methodological approach

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[3] Along these lines, Lubell, Feiock and Handy (2009) test the theory that "interest groups with pro-environmental attitudes will counterbalance development interests."

offers a refinement of understanding the effects of industry-oriented interest groups on policy processes.

Most other studies use only one all-encompassing variable to represent industry groups, which is more common in policy studies. However, it is important to recognize that business or industrial interest groups are not homogenous. Analyzing business groups in a single category fails to discern the ideological spectrums that exist within and across interest groups. There is complexity in interest group composition, and it is important to understand how these diverse interests – albeit within the same economic or industrial category – operate in an important policy area – sustainability policy.

This dissertation builds on extent research in political science, economics and policy studies fields. Interest group scholarship and micro-economic theory provides a theoretical foundation to explore the effects of business interest groups on urban sustainability policy adoption in one specific sector – buildings. Extent literature on the effects of business interest groups on sustainability policy adoption is varied – finding a mix of positive and negative effects - partially due to differences in definitions of interest groups, the types of policies, and the levels of government being researched. This work attempts to add insights into these aspects of urban sustainability literature.

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Chapter 3 Segmenting the Construction Industry: A Quantitative Study of Business Interest Groups in a Low Salience Policy Setting

Abstract: This study explores a low salience policy issue to examine the influence of distinct segments of business interest groups on local policy decisions drawing from two competing theoretical angles - private and public interest group theory. It analyzes the effects of two types of organized interest groups – traditional construction and green building association members - on the adoption of building energy codes, the policies that regulate the energy efficiency of buildings. Logistic regression is used to explain the probability of code stringency given differences in the presence of trade association members in cities while controlling for demographic, social, and political factors. The outcome of this research is an estimate of effects of traditional and 'green' interest groups on local building energy code policies. This research finds that the traditional building interest group members have a greater negative effect on the odds of a city's energy code adoption compared to the green builder interest group.

Keywords: urban policy, microeconomics, business influence, building codes, sustainability

Introduction

Commercial and residential buildings are responsible for approximately 12 percent of the U.S. greenhouse emissions portfolio (US Environmental Protection Agency, 2017). While the environmental impact of buildings is a central concern for environmental sustainability and climate change mitigation (Williams et al., 2012), the buildings policy domain is rarely studied as it is considered low salience and researchers tend to focus on higher salience situations (Go, 2016; Koski, 2010). Low salience policy issues are generally characterized by low levels of political participation and public attention (Koski, 2010). These issue arenas can attract interest groups, but tend to engage a narrowly focused group of technical professionals, such as industry associations (Koski, 2010, p. 96). Patterns of power, influence and collusion of business interest groups in low salience urban policy settings are distinct from other issue arenas that attract widespread attention appealing to personal beliefs, such as immigration or gay rights. It is unknown how insights from the body of interest group scholarship, focused mostly on high salience issues, translates to low salience policy arenas at the local level. The extent to which firms assemble into groups to pursue profit maximization or assemble to promote public interest - an interplay of classical economic theory and neocorporatism – may depend on issue salience.

This research explores this interplay by analyzing the effects of two types of organized interest groups – traditional construction industry representatives and 'green' business professionals - on building energy code adoptions at the local level. It asks, *what are the effects of traditional and 'green' industry member associations on building energy code policy adoption?* The traditional developer community is associated with a pro-development ideology justifying urban growth for personal gain (Logan and Molotch, 1988; Molotch, 1976), in line with the classical economic viewpoint of the firm as a profit maximizer (Coase, 1937) and political economic theory of how firms form political coalitions towards the goal of resolving political conflicts (March, 1962). Interest group pluralism suggests that firms will compete with similar established groups within the same industry, such as green construction interest groups, and ultimately oppose environmental regulation that imposes cost burdens and diffuse benefits to the firm (Scruggs, 2003). Contrastingly, green developers are associated with the neocorporatist theory that some firms act in the public interest on behalf of government (Kraft and Kamieniecki, 2007; Scruggs, 2003). These firms often 'float' the burden of added costs to construct buildings according to stringent environmental standards, meaning that the green construction firm absorbs the incremental cost during the construction process and the extent to which the consumer will absorb the cost is seemingly uncertain.

Segmenting actors within an industrial group – such as traditional and 'green' construction industry actors – is intended to deepen the understanding of diverse business interest groups effects on sustainability policy adoption at the local level, an endeavor that has been requested in past research (e.g., Portney, 2009; Sharp, Daley, and Lynch, 2011, p. 438). Extent literature has recognized that business interest groups are not homogenous and diversity of business interest groups has been largely explored through surveys (e.g., Berry and Portney, 2013), yet business interest group diversity has not been tested much in a quantitative way. Many scholars tend to consider business interests with respect to environmental policy as always pursuing deregulation (e.g., Kamieniecki, 2006, p. 53), yet some industry professional groups might support regulations that are in the public interest, or in favor of their own market differentiation and growth. Bringing more clarity and precision to understanding this empowered group of stakeholders is important, accomplished by bridging microeconomic theories of firms, interest groups scholarship and urban policy research. Analyzing business groups in a single category, as typically done in urban policy research, fails to discern the motivational spectrum that exist within and across interest groups. There is more complexity in interest group composition than commonly realized, and it is important to understand how these diverse interests, albeit within the same economic or industrial category, operate in an important policy area.

This study proceeds as follows. In the theory section, I explore conditions under which business interest groups are expected to support or oppose environmental regulations and review empirical findings from relevant extent research leading to three hypotheses. Next, I provide background information on building energy codes to orient the reader to the case selection. In the research design section, I provide descriptions of the variables and expectations on how the variables relate to policy adoption, mostly drawing from urban sustainability research. Next, I provide results from logistic regression modeling and exponentiate the coefficients into odds ratios for easier interpretation of the model. I conclude the study with a discussion of the modeling results as it relates to broader explanations of interest group activity and cities' actions on policy adoption, ending with the article's contribution to urban sustainability literature.

Theory and Hypotheses

Multiple theories generate expectations of how business interest groups will act in policy adoption settings. These theories commonly address the *motivations* of business interest groups, and predict divergent outcomes in support or opposition of environmental policy depending on the group's motivations (Table 3-1). The classical economic perspective that businesses are comprised of executives who are rational profit-maximizers underlies the idea that private firms will oppose environmental regulation because regulation is perceived to limit profits from industrial development (Kamieniecki, 2006; March, 1962). However, recent discussions have posed that many private sector actors are irrational in an economic sense guided by the desire of individuals and groups to act for the common good (e.g., Portney, 2013; Portney and Berry, 2016). These divergent perspectives have been broadly labeled as private and public interest group theories (see Jenner et al., 2012). Private interest group theory expects that industry-oriented interest groups will oppose environmental regulation in the interest of personal gain while the public perspective offers the viewpoint for support of environmental regulation in the interest of common welfare.

[Insert Table 3-1 Here]

Private Interest Group Theory

With interest groups conceptualized as “any set of individuals with similar beliefs, identifications, or interests” (Baumgartner and Leech, 1998, p. 29), the traditional economic perspective proposes that economically rational individuals seek to maximize their positions in society (Berry and Wilcox, 2009, p. 64). Some individuals join interest groups as leverage to improve their position. Economically rational and politically strategic individuals will work to advance policy alternatives where their benefits are concentrated for self-interest and costs are diffused to other members of society (Olson, 1965). Along this line of reasoning, energy efficient building mandates are expected to foster opposition from the construction industry as the incremental construction costs are incurred by the construction professional (Deslatte and Swann, 2016, p. 584; Wilms, 1982, p. 555). In the ‘split incentive’ case when the builder incurs the costs but others receive the benefits, the benefits of energy codes are granted to the buildings’ buyers in terms of lower building operating costs, tenants who enjoy increased building occupant comfort, and society at large who benefits from lesser environmental impacts (Sun et al, 2016, p. 3). Construction professionals are not expected to support such scenarios as it would be financially disadvantageous to the builder. Generally, construction professionals are expected to collude within an interest group towards the common goal of supporting policies that favor growth and development and minimize financial losses to the business (Feiock, Tavares and Lubell, 2008; Logan and Molotch, 1988; March, 1962; Molotch, 1976, p. 311).

May and Koski (2007) found that interest groups opposing energy efficient mandates had three times stronger influence than interest groups supporting the mandates (p. 59). In the study, May and Koski (2007) surveyed state homebuilder associations, national building code organizations, professional architect organizations and other groups involved in building energy advocacy about their influence, measured by asking whether they supported, opposed or were not involved in the policy adoption process for energy efficient mandates (May and Koski, 2007, p. 57).

> H1 (Oppositional): Higher numbers of traditional construction industry interest group members per capita are likely to limit the probability of the adoption of energy efficient mandates that apply to privately-owned buildings and development projects.

Public Interest Group Theory

As economic rationality failed to explain cooperation among actors in otherwise competitive environments, behavioral theories of rational choice emerged to argue that individuals within groups are less economically rational than Olson (1965) and other interest group analysts had assumed (Berry et al., 2006; Ostrom, 1990, 1998; Schattschneider, 1975). Berry et al. (2006) express,

> "… the initial theory, popularized by Mancur Olson, badly underestimated the propensity of individuals to be, in economists' jargon, "irrational." That is, Americans have proven that they are all too willing to join organizations that command tangible costs, such as volunteer time or financial contributions, but offer ideological rather than material rewards… their work tended to be more ideological than self-interested" (p. 11)

Along these lines, Ostrom (1990) had found that in some situations, people naturally organize to manage common pool resources in support of local public goods. The extent to which this line of reasoning applies to firms is unknown. Some construction professionals might support new building codes to better provision public goods for their clients and society in terms of cleaner air resulting from energy use reduction in buildings and selection of cleaner fuel sources for buildings. While their motivations may partially be self-interested in attempt to secure business from clients who demand cleaner buildings, green building construction professionals and their associated interest groups are still supporting codes that, in effect, protect common pool resources.

In the area of corporate environmental responsibility asking why some firms embrace environmental initiatives while others do not in, Bansal and Roth (2000) identify regulatory compliance, economic opportunities, stakeholder pressures and ethical concerns as key motivations. Multiple studies find that stakeholder pressures are the most important determinant, as clients and investors call for environmental protection (e.g., Darnall, Potoski and Praskash, 2009; González-Benito and González-Benito, 2006). Firms can garner a positive reputation through their support of environmental initiatives, creating a competitive edge for the company (Bansal and Roth, 2000, p. 724). Determining which motivational factor is most prevalent in the green construction industry is beyond the scope of this study, but we can assume that an interaction of the aforementioned motivations, including market differentiation, stakeholder responsiveness and ethical motivations, inspires construction firms to operate in the green building market.

> H2 (Supportive): Higher numbers of green construction industry interest group members per capita are likely to increase the probability of the adoption of energy efficient mandates that apply to privately-owned buildings and development projects.

Counterbalanced Opposition and Support

Orthodox pluralism conceptualized urban policymaking as engagement among diverse ethnic, racial, cultural and social groups. More recent neopluralism as well as neocorporatism has emphasized cooperation rather than conflict among diverse groups (Berry, 2010; May and Koski, 2007; Schuggs, 2003), as well as less participation of groups in policymaking than previously considered (Schumaker, 2013). The idea is that pluralist institutions are open to such a wide diversity of groups, the institution is less likely to be dominated by a single group (Schuggs, 2003). Some policy domains appear to be "groupless" (Peterson, 1981, p. 116), meaning that organized groups are expected to influence policymaking less than other factors such as economic conditions or values held by politicians (Schumaker, 2013, p. 263). Grouplessness may be a misinterpretation of the group consensus-building process that occurs prior to proposing a policy recommendation to elected officials, described as "board room" politics (Gormley, 1986). This phenomenon has been tested on green building mandates (May and Koski, 2007) and bipartisan agenda-setting for renewable energy policy (Brown and Hess, 2016). These studies suggest that what is actually occurring is counterbalancing, a close relative to grouplessness, that occurs when oppositional interest groups reach consensus or their policy position is otherwise negotiated and shifted towards the middle. For example, Lubell, Feiock, and Handy (2009) test the theory that "interest groups with pro-environmental attitudes will counterbalance development interests." Along this line of reasoning, the counterbalanced hypothesis is proposed:

> H3 (Counterbalanced): When the proportion of traditional and green construction interest group members per capita is roughly equal, construction industry interest groups are not likely to have a statistically significant effect on the adoption of energy efficient building mandates.

Extent research reports mixed findings regarding the effects of interest groups on environmental and sustainability policy adoption. Research findings seem to depend on the nature of the interest groups and the type of policies being studied. In some studies, the inclusion of *business* groups in policy deliberations had no statistically significant effect on sustainability policy adoption but *environmental* group involvement did have an effect (Berry and Portney, 2013; Portney and Berry, 2016). Deslatte and Swann (2016) found a different breakdown of interest group effects, discovering that neighborhood associations and corporations were statistically significant in selecting a bundle of energy policy tools but many groups were not statistically significant, such as chambers, general public, environmental groups, developers or HOAs.

Effects seem to also depend on the type of policy, which is the dependent variable in the statistical models in the reviewed literature. For example, when modeling green construction policies, land use decisions, and energy information separately, Deslatte and Swann (2016) found that *environmental groups* were significant while *developers* were not. Regarding the strength of influence, May and Koski (2007) found that homebuilder's associations had the strongest opposition to building codes, with three times greater influence than advocacy groups including energy code associations and conservation groups (p. 57). Looking across extent research studies, the significance of various types of interest groups in environmental and sustainability policy adoptions has been inconclusive.

In a study not in urban policy literature but rather in energy policy studies, Jenner et al. (2012) examined interest group influence on renewable energy policy adoption. The interest groups were operationalized by years of existence of state chapters of the International Solar Energy Association (ISEA) and National Nuclear Association (NNA). The effect sizes for the solar chapters range from 1.33 to 3.77 in relative odds of policy adoption and nuclear chapters range from -0.24 to 0.67. Overall, the effects of interest groups on urban policy adoption are varied across studies, from having no effect to having a strong effect. The type of sustainability policy and type of interest group seems to matter to the assessment of interest group effects on policy adoption.

Background on Building Energy Codes

Building codes are an interactive set of technical policy statements that govern all aspects of buildings, including structural engineering, fire and life safety, electrical, mechanical, and fenestration. The codes include thousands of individual policy statements that correspond with or are conditional on other statements within the set of codes. Building energy codes are the policies that govern the energy efficiency component of buildings (e.g., International Code Council, 2012). Building codes are continually developed by a nonprofit, the International Code Council (ICC) over the course of three years, and elected officials at every level of government have the option to adopt the revised building codes in staggered three or six year cycles.

The policies are administered by code officials who are government staff or contractors and implemented by construction industry professionals during the building design and construction process. Across the United States, the process of building is regulated at the state and local levels, aside from federal buildings which are regulated at the federal level. Plans for new construction must go through a state or local government permit process before building begins and this process ensures that builders meet local codes. Throughout these steps, particularly during the code development and adoption processes, a network of construction industry professionals, environmental advocacy groups, code officials, and elected officials share information, develop policy proposals, and compete for policy change (Building Codes Assistance Project, 2017).

The expanded scope of codes to include energy efficiency was initiated as a result of the 1992 Energy Policy and Conservation Act (EPCA) when commercial energy code adoption (but not enforcement) became mandated for states (Lee and Yik, 2004, p. 482; Nelson, 2012, p. 183). However, mainly due to limited federal authority in mandating subnational codes due to the federalist structure in the United States that grants power to the states, fifteen years later only 70 percent of states had some sort of energy code - mostly for commercial buildings and not residential buildings - and the codes have been poorly enforced (Nelson, 2012, p. 183). State statutory structures largely determine code adoption at the local level. Some states require the local jurisdictions to meet or exceed the state code (e.g., California) while other states require local jurisdictions to *not exceed* state law (e.g., Utah). Some states have a home rule structure where local governments have the authority to adopt codes independent of the state code (e.g., Colorado, Arizona) (International Code Council, 2017).

Nelson (2012) built a dataset of state level code adoption from 1977 to 2006. On average, states had adopted only two energy code versions over those 30 years (Nelson, 2012, p. 186). More recently, there has been a notable increase in governments' adoption of energy codes. Many governments have adopted two or three new codes over the last decade. The American Recovery and Reinvestment Act of 2009 signed into law by President Obama required states receiving stimulus funding to meet or exceed the 2009 International Energy Conservation Code or its equivalent, ASHRAE Standard 90.1-2007 (U.S. DOE, 2017). Thus, the 2009 energy code version is considered the contemporary status quo and previously dated codes are obsolete. Some states accepted stimulus funding but refused to adopt the 2009 energy codes, arguing that the state did not have authority over codes.

Building energy codes are particularly interesting to study because energy codes represent a clear divergence between the traditional building codes that regulate structures, fire and life safety, and the expanded scope of codes that also regulate energy efficiency, causing a point of contention among industry professionals who fear that code advancement will cut into profits and create hardship for their companies. A 2016 blog excerpt from the environmental nonprofit advocacy group, National Resources Defense Council (NRDC) on the 2018 code development hearings captures typical controversies around energy codes:

> "Given how critical strong building energy codes are in the fight against the dangers of climate change, recent events in the residential energy code development process are very troubling. Code officials, builders, energy efficiency advocates, and others met last month in Louisville, KY for Technical Advisory Committee hearings for the development of the 2018 International Energy Conservation Code. Unfortunately for those of us who recognize energy efficiency as an unequivocal win for both homeowners and the environment, the advisory committee was beholden to the desires of the building industry to stick with the status quo—or worse. Advisory committee members not only rejected just about every proposal that would increase the energy efficiency—and therefore, the important climate benefits—of the energy code, they also took steps to roll back its efficiency."
>
> (NRDC and Urbanek, 2016)

Indeed, adding energy to the model codes has continuously caused backlash from the traditional construction industry, including many builders and code officials alike, who reject that mandatory building codes should be expanded from their central focus on structural stability, fire and life safety to also regulate environmental issues (Eisenberg and Yost, 2004). However, energy codes are arguably the most effective way to reduce energy consumption and greenhouse gas emissions from the buildings sector because this mandatory policy tool applies to all new construction and major renovation of existing buildings, prompting environmental advocates to oppose conservation industry professionals and code officials (Lee and Yik, 2004, p. 479). The 2012 energy code version was determined to achieve 30 percent more energy efficiency than buildings constructed to the 2006 energy code version (U.S. DOE, 2014). Given the 50 percent growth rate in U.S. buildings since 1980 and expected exponential growth over the next few decades (U.S. Energy Information Administration, 2017), regulating new building construction is imperative to reaching governments' climate, energy, and sustainability goals (Nelson, 2012).

Research Design

Case Selection and Dependent Variable

Historical code adoption data is not readily available at the local level. Rather, only current code statuses are available for municipalities. The interest of this study is to examine the contemporary energy code policy arena rather than the historical trends when codes were updated far less frequently. Thus, the most recently adopted version of the energy code is used to construct the dependent variable.

In home rule states, energy code adoptions are typically tracked at the city levels whereas in non-home rule states codes are typically tracked at the state levels due to resource constraints of energy code advocacy groups and government agencies that perform code tracking. Further, more variation of energy code versions exists across cities in home rule states compared to non-home rule states (Cort and Butner, 2012), providing optimal case selection. It is unknown the extent to which the results are generalizable to the other 44 states, as state level activity may attract different types of policy actors and interest groups.

The study involves statistical modeling 221 cities within seven home rule states (Arizona, Colorado, Kansas, Missouri, North Dakota, South Dakota, Wyoming) to understand cities' actions when granted autonomy by their state legislatures. The sample size is limited to cities whose energy code adoptions are tracked by national, state or local organizations, including data collected from the International Code Council (ICC) and Building Codes Assistance Project (BCAP) as well as information from city ordinances and webpages that is easily accessible using modern data collection tools, as explained below. The ICC randomly collects code adoption information by allowing jurisdictions to self-report adopted codes on the ICC website and by leveraging local relationships to stay up-to-date on code changes (ICC, 2017). BCAP, a program within the Alliance to Save Energy, has a similar process for code tracking (BCAP, 2018). In an attempt to collect additional data beyond what is available from ICC and BCAP, I used the Python package, *Google* to programmatically return a list of URLs from the search string, *"city of" [state name] adopts international energy conservation code*. Most web links pointed to a city's building code or a city's web page that lists the currently adopted building codes. Two of the weblinks pointed to databases of local code adoptions maintained by the States of Colorado and Kansas. Very few local code websites were found in North Dakota, South Dakota and Wyoming. I reviewed each landing page to add to the data set of adopted code version and year of last code update.

The dependent variable contains two ordered categories: the base level represents municipalities with outdated energy codes, ranging from no energy codes to the 2009 International Energy Conservation Code (IECC) version. The second category represents the most up-to-date energy codes, including cities that have adopted the 2012 or 2015 IECC versions. Table 3-2 shows the fairly balanced distribution of local policy adoptions in cities within home rules states.

[Insert Table 3-2 Here]

Focal Independent Variables

In this study, the interest group variable is constructed using counts of traditional construction industry association members and green building association members normalized by population, similar to the interest group variable construction in previous studies (e.g., Baumgartner and Leech, 1998; Gilens and Page, 2014; Jenner et al., 2012; May and Koski, 2007). I also create a "member proportion" variable to operationalize the proportion of traditional to green interest group members per capita to measure effects when the presence of the two groups are roughly equal in a city. I select the ratio of 2 to 1 or less as a measure of "roughly equal" based on an analysis of the data. The member proportion variable is dichotomously coded as 0 or 1.

Dues-paying trade association membership represents interest group presence in a city. The two most prominent trade associations that participate in local energy code policy processes across U.S. cities are the US Green Building Council (USGBC) with more than 12,000 members (US Green Building Council, 2017) and the National Association of Homebuilders (NAHB) with more than 140,000 members, one third of which are builders and remodelers (NAHB, 2017). Both groups have paid staff and local chapters that lobby locally and mobilize their members to support their group's policy goals. While it is not ideal to use member counts because not all members participate in local policy processes, some degree of member inactivity occurs in both types of trade associations so the effect of member inactivity is naturally occurring across the two types of groups. The USGBC member list is available as an Excel download in its entirety, whereas the NAHB member list was created by examining member address locations from member directories hosted by local associations. The NAHB data was collected using the Python Beautiful Soup program to programmatically read data from association webpages.

Political and Community Characteristics (Control Variables)

Political Institutions. The conventional viewpoint is that mayor-council forms of government are expected to be more open to the influences of interest groups compared to council-manager governments (Bae and Feiock, 2013; Hawkins, Krause, Feiock and Curley, 2016; Sharp, Daley and Lynch, 2011). Theoretically, the council-manager governments enable sustainability departments to be somewhat insulated from political pressures and better able to respond to policy issues with a relatively unbiased long-term, technical approach that emphasizes operational efficiencies compared to government departments within mayoral forms of government (Bae and Feiock, 2013; Daley, Sharp and Bae, 2013; Krause and Douglas, 2005). Further, in a low salience, technical policy arena such as building energy codes, council-manager institutional structure is expected to be more likely to have government staff engage with technical experts to craft a building code policy that has better chances of being adopted than a code policy that does not include technical input from building professionals prior to the policy hearing (Brown and Hess, 2016; Gormely, 1986; May and Koski, 2007). The political institutions variable is dichotomously coded as mayor-council form of government (1) or other form of government (0).

Climate Commitment. A measure of city support is whether they have made a public commitment to climate protection, as indicated by mayoral signatories to the Climate Protection Agreement or if the city is a member of ICLEI Local Governments for Sustainability. The choice to construct this variable by combining data on mayoral signatories and ICLEI members is intended to capture preferences and constraints by different types of local governments. ICLEI membership costs money and may be out of reach for some cities (Yi, Krause and Feiock, 2017). Additionally, ICLEI membership supports a technocratic approach to city sustainability where technical resources are utilized by the local governments (Krause, Feiock and Hawkins, 2016, p. 117). The variable construction is intended to capture the variety of approaches that cities take to sustainability whether the efforts are led by the mayor or city manager as directed by the city council. It is dichotomously coded for cities that have made a climate commitment (1) or not (0).

Government and Industry Capacity. In most cities, the city planning and building department relies on general revenue and/or development permit fees to fund government staff to implement buildings policies. In the absence of a centralized data source for development permit fees, general revenue is used as a measure of government capacity for adopting new building policies, as cities with greater financial health are more likely to adopt sustainability policies (Krause, 2011; Lubell et al., 2009; Sharp et al., 2011). I use general revenue per capita as a measure of government and industry capacity.

Secondly, a measure of government and industry capacity for advancing building codes is the number of construction industry professionals in the community, as this industry is expected to generate income for the government in terms of tax revenue and building permit fees and a larger construction industry is more likely to have technical expertise to contribute to shaping and implementing new building code policies. The Chief Building Official with input from staff is typically responsible for presenting building code proposals to the legislative branch. When building and development in a community is low, then the planning/building department has very limited capacity and is less likely to propose code advancements because code advancements have transaction costs including training needed for government staff and industry members (Nelson, 2012). Governments are less likely to impose added financial burdens on the construction industry when construction activity is low. Further, some cities have vastly different quantities of construction activity than other cities, so code advancements could be a lower priority in cities with little to no new construction. Population and the number of construction workers in a city are correlated variables, so only population is included in the model.

City Size and Socioeconomic Conditions: Population, Income and Education. Cities with large populations are likely to experience urbanization pressures, such as limited land availability and high building density, which in turn puts demands on energy and water resources. These pressures are likely to cause governments to adopt more stringent energy codes to control building growth and resource use (Cidell and Cope, 2014; Daley, Sharp and Bae, 2013; Kontokosta, 2011; Saha, 2009). However, cities also need income from tax revenue and building permits to afford new code adoptions and do not want to deter builders from bringing jobs and capital into the community. Thus, code stringency can be seen as a privilege afforded by cities with wealthy, educated residents where sustainability and advanced buildings policies are more likely to be supported (Hawkins et al., 2016; Lee and Koski, 2012; Sharp et al., 2011). May and Koski also found that states with a larger construction sector were more likely to adopt green building mandates, insinuating that energy efficiency is more prevalent in booming construction markets where wealth is more widespread. To operationalize education, I use the percent of the population over age 25 that holds a Bachelor's degree or higher. For income, I use the median household income for each city. The city population is included in the models in the logged form.

Problem Severity. Cities may be more likely to adopt new building codes when buildings-related problems in their communities are heightened. Two measures of buildings-related issues are urbanization pressures from high levels of new construction activity and electricity costs. Cities vary widely in levels of construction activity. Some cities are mostly built-out with some infill development but little to no land for new subdivisions. Other cities have plentiful opportunities for new construction, either by demolishing existing buildings or using vacant land. Cities with high new construction activity have more opportunity to be impacted by modern codes than cities with less activity. The median housing age in the community accounts for this variation.

When energy is costly, communities are more likely to seek opportunities for energy savings, such as through energy codes. Cities with higher local energy costs have more opportunity to gain costs savings from building operations achieved by modern energy code advancements (Nelson, 2012). Where energy is costlier, the payback period on energy efficiency improvements is lesser compared to places where energy is cheaper. I expect that higher energy costs, measured by average electricity costs per county, are associated with higher likelihood to adopt more stringent energy codes. Where county data is not available, I take the average electricity cost for the state. Table 3-3 shows the descriptions and sources for all variables.

[Insert Table 3-3 Here]

Data Analysis and Discussion

Exploratory data analysis lends insights into how the data will perform in the regression model. As expected, far more USGBC members are present in cities with modern codes than in cities with outdated codes, anticipating a positive coefficient on the green interest group variable (Table 3-4). Further, far more cities with modern codes have commitments from political leadership as signatories of the Mayor's Climate Protection Agreement or ICLEI members, so we can expect the climate commitment variable to have a positive effect as well. General revenue, population, household income and education are all higher in cities with modern codes. The max median age of housing is lower in cities with modern codes than outdated codes, suggesting that higher levels of new construction activity relative to the total building stock in these cities are happening under outdated codes. This could signify the desire of cities to attract construction activity as a way to generate revenue and jobs by keeping old building codes that are more flexible and less costly for construction workers to build to. Surprisingly, the average and maximum unit costs of energy is lower in cities with modern codes. I would have expected the energy costs to be higher in these cities, and that they would use energy codes as a way to lower energy costs for homeowners and tenants.

[Insert Table 3-4 Here]

Model Selection

The regression model includes 221 cities: 76 cities with outdated energy codes and 145 cities with modern energy codes. The number of observations is limited to cities where code adoption information is readily available and control variables matched on city name and state. The dependent variable has two categories of building energy codes representing an increased level of code stringency, from outdated codes to modern codes. For this study, the outdated codes are grouped as the IECC 2009 and any code version published before the IECC 2009, and modern codes are the 2012 and 2015 IECC. As stated in the Background section, the 2009 IECC is considered status quo as it was required as a condition for subnational governments receiving stimulus funding under the American Recovery and Reinvestment Act of 2009. Given the nature of the dependent variable, logistic regression is used to estimate the effects of trade association members on code stringency in local jurisdictions while controlling for social, economic, and political factors. The regression with logit link function estimates the log odds that the event occurs. The model estimates the coefficients corresponding to each focal predictor and control variables. Due to lack of interpretability of log odds, the logit coefficients are converted to odds ratios calculating the odds that the city has adopted modern codes given the vector of X values. The exponent of the coefficient is the odds ratio.

Parameter Estimates

Traditional industry association groups are hypothesized to be less concerned about negative externalities associated with the environmental impacts from buildings and more concerned with maximizing profits, and therefore less likely to internalize incremental building costs. This theory is supported as traditional industry association groups are associated with lower levels of modern energy code adoption (Table 3-5). Holding all other independent variables at their means, a one standard deviation increase in traditional members per 1000 people decreases the odds of modern energy code adoption by 16 percent.

[Insert Table 3-5 Here]

Green building interests seek to gain profits within the construction industry but may be willing to internalize some of the incremental costs associated with building green, which is supported if the green building interest group is associated with higher levels of energy code adoption. This hypothesis is not supported by the model as the green interest group variable is not statistically significant. The effect of green interest groups is generally positive but the standard errors are too large to get a reliable estimate of the effects. The lack of significance of the green interest group could be explained by these members building beyond baseline codes and therefore not being overly concerned with the stringency of building energy codes. They are building to above-code standards given their association with the green building program, Leadership in Energy and Environmental Design (LEED). Their building expertise is already at an advanced level that goes above baseline building codes.

The member proportion variable indicating when the balance of traditional and green industry association members is roughly equal – determined if the ratio of traditional to green interest groups is 2:1 or less - attempts to capture the stakeholder engagement process that commonly occurs within the energy code policy arena where interest groups negotiate a code change package that works for both sides described by the "counterbalanced" hypothesis[4]. Statistically speaking, this is the null hypothesis as neither membership group is expected to have an effect on energy code policy adoption when this scenario occurs. Again, the standard errors are quite large on the member proportion variable, so the model has difficultly generating a reliable parameter estimate.

Regarding the control variables, the form of government does not seem to matter when it comes to modern energy code adoption. Energy codes have advanced nearly equally in cities with council-manager governments and mayor-council governments. This is surprising given the technical nature of building codes and the tendency for governments with city managers to be more likely to collaborate with community stakeholders on policy development, presumably finding technical specifications that work for local building practices. It could be that the mayor-council governments are able to push building codes through the policy adoption process with less engagement from the building community. While the codes might get through the adoption process, engagement with the building community in designing the building codes could make policy *implementation* more effective. The adoption of modern building codes does not

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[4] The member proportion variable is generated from two other independent variables. Testing for multicollinearity, the Variance Inflation Factor on the member proportion variable is 1.76, indicating a very moderate level of multicollinearity. Withholding the member proportion variable from the model does not substantially alter the coefficients or significance on any other variables.

necessarily guarantee compliance by the industry, which is expected to be improved when stakeholders are engaged in the policy design. A commitment by local executives to climate protection, indicated by signing the Mayor's Climate Protection Agreement or becoming members of ICLEI, increases the odds that a city will adopt higher levels of energy codes by 2.18, as cities commonly use building codes as a strategy to meet their local energy goals (Table 3-6).

[Insert Table 3-6 Here]

Cities with greater financial resources are more likely to advance codes. Code advancements do have transaction costs, such as training programs and new code books for contractors and building department staff, that are commonly absorbed by the city. While *city* fiscal conditions are correlated with modern code adoption, *household* income is not. Building energy code advancements have been framed as a way to protect lower income households from rising energy costs. This could explain why modern building codes are advanced in communities with diverse household incomes. Population is very significant to modern energy code adoption, while education is not. Urban sustainability literature commonly finds that higher income and education levels are correlated with more sustainability policy adoption, but building codes are a foundational policy option sometimes grouped with sustainability policies but sometimes not. The sustainability departments may be engaged in building energy code adoptions as it may be one strategy on their broader agenda, but the heavy lifting of building energy code adoption is typically executed by the building and planning departments. Thus, expectations for the income and education variables that come from sustainability literature might not be entirely applicable to the building code policy domain.

Regarding problem severity, the cost of electricity is expected to be correlated with energy code adoptions as the payback period for energy efficiency improvements is shorter when energy costs are higher, making energy efficiency more attractive as a solution to high energy costs. Another interpretation is that energy costs would be lower where communities better handle their energy demand with energy efficiency programs. In reality, energy politics are far more complex than that. For example, cities in Wyoming have very inexpensive energy with an average cost of only $0.08 per kWh compared to Kansas where average energy costs are $0.12 per kWh. The statistical modeling estimates that a one standard deviation increase in energy costs is correlated with an 18 percent decrease in the likelihood to adopt more stringent energy codes. This is counterintuitive and is likely picking up effects of energy conditions and energy mixes (i.e. mix of cheap coal compared to natural gas or renewables). Finally, the median year of housing age was expected to capture information about the levels of new construction activity in a community, but was not statistically significant.

Given that code adoption is under jurisdiction of the local governments in home rule states, the sample of data collected for this study suggests that, when given local autonomy, some local governments adopt modern building standards while others do not. Indeed, some communities have no energy codes or building codes at all. One might assume that building must not be occurring in the places with no or outdated codes. Yet, the Census estimations for construction industry worker in places with outdated codes is similar to cities with modern codes, suggesting that construction activity is present in these communities. Given that building energy codes are a critical policy tool for reaching global climate and energy goals, subsequent work could assess strategies for encouraging these communities to adopt modern building codes.

A limitation of this study is that it does not include all energy code interest groups due to resource constraints and lack of feasibility in collecting counts on each interest group involved in energy code policy advocacy. The Building Codes Assistance Project has designed an "energy codes universe" that illustrates the multitude of interest groups, nonprofits and government agencies involved in the energy code policy processes involving code development, adoption, implementation, and enforcement (BCAP, 2017). While this study examined a few of the most widely-known groups, subsequent research could further examine actors in the energy code policy arena. An obvious case selection to study is the code development hearings where the various stakeholders join to testify their company's stance on code proposals, government members vote on the proposals, and an elected committee mediates. Subsequent research could review testimony to give insights into the code debates in a formal, well-established policy setting.

Conclusion

This research adds depth to the collective understanding of the types of groups that are participating in urban sustainability policy processes while analyzing organized interest groups in a highly technical sector of urban sustainability: building energy use. To date, sustainability research has examined policy activity in an aggregate fashion, grouping initiatives from multiple sectors together to better understand why some governments pursue sustainability, and others do not. While this provides valuable insight, as the field of inquiry grows, it is important to more deeply explore specific sectors to better understand decision-making. The actor groups that are responsible for many aspects of the policy processes are overlooked because they are sector-specific (Koski, 2010). This research adds a building block to sectoral research intended to be nested within broader sustainability research. Building codes and green building programs in particular hold considerable promise for reducing greenhouse gas emissions, and yet, the politics and interest group mobilization is understudied.

This study examines the power of interest groups in shaping the energy efficiency building requirements that cities adopt as mechanisms to achieve their sustainability goals. It examines the effects of traditional and 'green' industry member associations on policy adoption for energy efficient buildings. Private interest group theory anticipates the opposition of environmental regulation from business interest groups in the pursuit of profit maximization while public interest group theory predicts that business interest groups will support environmental regulation motivated by the protection of common public goods while being reasonably profitable.

When granted local autonomy by their state legislatures under a home rule institutional structure, some cities pursue energy code stringency while others do not. Modeling 221 cities within seven home rule states, I find that the presence of traditional building interest group members affiliated with the National Association of Homebuilders decreases the odds of modern energy code adoption by 16 percent. The presence of 'green' interest group members from the U.S. Green Building Council has a positive effect on building energy codes, but the standard errors are too large to generate a reliable parameter estimate. This could be explained by the association members already building to higher standards and unconcerned with the advancement of building energy codes. Having the most effect on energy code adoption, a city's commitment to climate protection more than doubles the likelihood of adoption, indicating the strong relationship between urban sustainability, climate protection and building energy codes.

Tables and Figures

Table 3-1. Expected Direction of Coefficients in the Energy Code Adoption Model

Theory	Policy Position	Direction of Coefficient
Private interest	Oppositional	Negative
Public interest	Supportive	Positive
Counterbalanced	Negotiated	No Effect/Null Hypothesis

Table 3-2. Most Recently Adopted Energy Code in Cities within Home Rule States

State	No Codes	≤ 2009 IECC	2012 IECC	2015 IECC
AZ	2 (4%)	16 (35%)	23 (50%)	5 (11%)
CO	0	21 (39%)	10 (19%)	23 (43%)
KS	37 (61%)	8 (13%)	14 (23%)	2 (3%)
MO	22 (5%)	13 (32%)	9 (24%)	14 (37%)
ND	0	2 (29%)	0	5 (71%)
SD	5 (71%)	1 (14%)	1 (14%)	0
WY	1 (13%)	0	2 (25%)	5 (63%)
Total	47 (21%)	61 (28%)	59 (27%)	54 (24%)

Table 3-3. Variables, Descriptions, and Data Sources for Energy Codes Model

Variable	Description
Dependent Variables	
Policy adoption or non-adoption	Adoption of building energy codes by version (Outdated: No codes to 2009 IECC; Modern: 2012-2015 IECC. Source: Databases publically available from ICC, BCAP, DOE; city, state websites
Interest Groups (Focal Predictors)	
Green business interest group	Number of USBGC members in each city normalized per capita (1,000). Source: USGBC member list, 2018
Traditional business interest group	Number of BOMA and NAHB members in each city normalized per capita (1,000). Source: BOMA & NAHB member directories, 2018
Member proportion	Dichotomous variable (1) for city with roughly equal traditional and green industry members (ratio of 2:1 or less)
Political and Community Characteristics (Control Variables)	
Political Institutions and Climate Commitment	
Form of government	Dichotomous variable for city that has a mayor-council form of government (1) or other form of government (0). Source: ICMA Survey, 2011
Climate commitment	Dichotomous variable for city that is a signatory of Climate Protection Agreement or ICLEI member. Source: U.S. Conf. of Mayors, 2018; ICLEI, 2018
California	Dichotomous variable for city that is located in California.
Government and Industry Capacity	
General revenue	Per capita general revenue for each city ($1000s). Source: Census of Governments, 2012
City Characteristics and Socioeconomic Conditions	
Population	Logged population of each city. Source: 2016 American Community Survey, 5 Year Estimates
Income	Median household income ($1000s). Source: 2016 American Community Survey, 5 Year Estimates
Education	Percent of population over age 25 with Bachelor's Degree or higher. Source: 2016 American Community Survey, 5 Year Estimates
Problem Severity	
Energy cost	Average cost of electricity (kWh) in each county. Where county data is not available, average cost in the state. Source: Energy Information Administration, 2017
Median housing age	Median age of housing stock in the city. Source: 2016 American Community Survey, 5 Year Estimates

Table 3-4. Descriptive Statistics for Energy Codes Model

	Outdated Codes n = 108			Modern Codes n = 113		
Statistic	Mean	Min	Max	Mean	Min	Max
Green interest group	0.13	0	2	0.31	0	3.54
Traditional interest group	0.87	0	13.4	0.73	0	8.92
Member proportion	0.36	0	1	0.19	0	1
Form of city government	0.21	0	1	0.23	0	1
Climate commitment	0.09	0	1	0.31	0	1
General revenue	2.38	0.5	109.91	2.99	0.4	136.66
Population	9.45	6.74	13.06	10.28	5.11	14.26
Income	53.65	19.38	119.52	66.58	27.4	246.53
Education	0.18	0.04	0.43	0.24	0.01	0.61
Energy cost	10.55	1.79	14.46	9.83	6.36	13.13
Housing age	1977	1939	2010	1981	1939	2005

Table 3-5. Logistic Regression Results from Modeling Energy Code Adoption

	Dependent variable: Energy Code Outdated (0) or Modern (1)	
Traditional interest group	-0.18*	(0.10)
Green interest group	0.41	(0.48)
Member proportion	0.29	(0.47)
Form of city government	0.57	(0.41)
Climate commitment	0.78*	(0.45)
General revenue	0.03**	(0.01)
Population	0.55***	(0.16)
Income	0.01	(0.01)
Education	0.04	(0.03)
Energy cost	-0.19**	(0.09)
Housing age	0.01	(0.01)
Observations	221	
Log Likelihood	-122.75	
Akaike Inf. Crit.	269.5	
R^2	0.25	
Note: Standard errors in parentheses	$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$	

Table 3-6. Odds Ratios for Energy Code Adoption

	Dependent variable: Energy Code Outdated (0) or Modern (1)	
Traditional interest group	0.84*	(0.10)
Green interest group	1.51	(0.48)
Member proportion	1.33	(0.47)
Form of city government	1.77	(0.41)
Climate commitment	2.18*	(0.45)
General revenue	1.03**	(0.01)
Population	1.73***	(0.16)
Income	1.01	(0.01)
Education	1.04	(0.03)
Energy cost	0.82**	(0.09)
Housing age	1.01	(0.01)
Observations	221	
Log Likelihood	-122.75	
Akaike Inf. Crit.	269.5	
Note: Standard errors in parentheses	*p<0.1; **p<0.05; ***p<0.01	

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Chapter 4 How Business Interest Groups Matter: Rare Events Modeling of Green Building Policy Adoption in Cities

Abstract: This study examines a specific type of business interest group – construction industry associations - involved in the green building policy arena to understand their effects on policy adoptions. Using rare events logit modeling, I estimate the effects of 'traditional' and 'green' industry associations on green building policy adoption while controlling for political, socio-economic and problem severity characteristics of cities. The results indicate that, not surprisingly, the presence of green industry association members increase the likelihood of local policy adoption. However, the traditional industry associations do not limit the probability of green building policy adoption as expected.

Keywords: *urban policy, cities, business interest groups, sustainability, green building*

Introduction

Green building policies, such as building certifications, prescriptive checklists, permit fee reductions and green building codes, have been diffusing throughout the United States continuously since the 1990s when the U.S. Green Building Council launched the Leadership in Energy and Environmental Design (LEED) program. While originally intended to be a voluntary program, many state and local governments are now requiring LEED certification for government, commercial, industrial and residential buildings within their jurisdiction. The widespread adoption of these green building policies provides an opportunity to better understand 1) how business interest groups that are known to be influential in this policy arena at national and state levels of government effect adoption at the local levels, and 2) if there are differences in effects depending on the target population of the policies - i.e. if LEED requirements apply to private or public buildings[5].

Adoption of green building varies across real estate markets and building types. The National Green Building Adoption Index that is published each year by the real estate company, CBRE, shows that almost 40 percent of office building square footage in 30 major real estate markets are certified to green or energy efficiency standards, up from 5 percent in 2005 indicating the growth in green buildings that has occurred over the past 15 years (CBRE, 2017). While this is impressive growth, it equates to only 4.7 percent of total physical buildings in these markets, suggesting that large office buildings in major real estate markets are more likely to be built to green standards than small buildings, industrial facilities, or buildings in small cities and towns with relatively non-competitive real estate markets (Gripne, Martel, and Lewandowski, 2014).

The cost to build green is typically offset by the market premium of the LEED certification. Research shows that building to green standards for office buildings costs 2-17 percent more compared to conventional office buildings depending on the certification level, credit selection, product and design choices, and other factors (Ross et al., 2007; USGBC, 2015; Zuo and Zhao, 2014). Green buildings command rental and sales price premiums of 3-17 percent and 13-26 percent, respectively (Gripne, Martel, and Lewandowski, 2014). Costs and returns on investments vary widely across the country, and in some real estate markets returns on investments have not been quantifiable due to limited data availability about construction costs

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[5] Public facilities in cities typically include convention centers, courthouses, fire stations, museums, warehouses, offices, parking garages, police stations, recreation facilities, schools, wastewater treatment plants (City of Kansas City, MO, 2017).

and real estate market prices (Gripne, Martel, and Lewandowski, 2014). Therefore, many construction industry professionals are hesitant to embrace green building as a construction practice, but early adopters may benefit from new market demand (Circo, 2008; Fuerst, Kontokosta, and McAllister, 2014; May and Koski, 2007).

The rapid green building market growth for some building types (e.g., office buildings) and slow progress for other types (e.g., industrial) as well as variation in costs and benefits lends to uncertainty in the marketplace and green building policy arena. This provides an ideal case selection to examine the roles and motivations of business interest groups at the local level, an understudied segment of the population in urban environmental policy research.

I begin this article with an exploration of theories on why various types of interest groups are expected to support or oppose green building policies that apply to public and private buildings. The theories lead into three hypotheses regarding the role of interest group association members on the adoption of local green building standards. Next I provide background information on the LEED program. I use rare events logit regression modeling to understand how two types of interest groups – traditional builders and green builders – correlate with policy adoption while controlling for political, socio-economic and problem severity factors. I find that the green building interest group is associated with increases in policy adoption while the traditional building interest group does not have an effect.

Theory and Hypotheses

Regulations for green buildings isolates a highly technical, low public salience policy option, tending to engage technical building experts with minimal news media or public attention to the issue (Koski, 2010). Green building policies typically specify if the policy applies to public buildings only, or to both public and private buildings. These policies can require building certifications or prescriptive checklists that require minimum building standards; offer expedited permitting by the government's building and planning departments when green building requirements are fulfilled by the builder; or provide financial incentives such as reduced permit fees. More recently, green building codes detailing prescriptive requirements for construction activity have been developed. Mostly these codes have been adopted in such a way that voluntary participation is encouraged rather than the mandatory compliance that is more commonly required with other building codes.

This work examines two types of industry interest groups - traditional industry and green building association members – within the same industry. I define 'green' industry association members as having the desire for construction and land development that enables less negative externalities than conventional buildings in terms of carbon emissions, auto-dependency and excess water consumption, for example, and more positive externalities such as better indoor air quality and reduced operating costs for building owners (Schindler, 2010). The green industry association members are associated with contemporary perspectives on corporate responsibility where business may act in ecological interests motivated by stakeholder pressures, as well as ethical motivations and a desire for new economic opportunity (Bansal and Roth, 2000). The traditional industry association members represent the classical economic view of the firm as a profit maximizer (March, 1962), associated with a motivation by profits for personal gains and less likelihood to internalize incremental costs associated with green building. Members in either organization include professionals such as builders, architects, designers and product suppliers.

Drawing from literature on economics, policy studies and sustainability, assorted factors help explain why various types of business interest groups are expected to support green building policies in some cases and oppose green building in other cases. Overall, some distinguishing factors include:

- whether the policy applies to public buildings only or also includes privately-owned buildings;
- if it is voluntary (e.g., permit fee reductions or other financial incentives) or mandatory (e.g., certification requirements or prescriptive green building codes); and
- the extent to which the industry group is expected to gain a market advantage from the policy adoption.

In extent research, empirical results on the effects of interest groups are widely varied. Some of the variation is explained by the aforementioned factors in addition to the level of government and how the interest group variable is constructed.

The extent research that explores business interest effects on green and sustainability policy adoption often does not recognize the importance of the distinction in the policy's target population, and how the target population is expected to mediate the effects. Research that uses privately-owned buildings as the case selection does not necessarily generalize to policies that apply to public buildings because of the differences in who pays the incremental costs to build to higher standards. Whether the target population of the policy is public or privately-owned buildings is often not overtly recognized as a critical emphasis or isolated in statistical modeling, even though the scope of a policy has long been acknowledged as a theoretical determinant in policy adoption (Schattschneider, 1975).

The works of May and Koski (2007) and Koski and Lee (2012) are among the exceptions of literature that deeply considers how the target population matters in the urban sustainability literature. May and Koski (2007) provide the insight, "The seemingly benign politics of state adoption of green building requirements defies the conventional depiction of environmental policymaking as pitting industry against environmental interests", explaining that "green building requirements are aimed at practices of public agencies whereas the environmental regulatory focus is typically the behavior of firms" (p. 50). From this line of research, we can expect construction industry groups on the whole to support green building mandates that apply to *public* buildings.

However, May and Koski (2007) did not find that homebuilders support environmental policies for public buildings at the state-level. They found that the presence of interest groups had significant effects on the adoption of green building mandates for public buildings, with three times greater *negative* influence by oppositional groups such as homebuilders (p. 59). Interest group effects are expected to be more significant at the state and national levels than local levels because interest groups are generally more active at higher levels of government particularly with paid professionals lobbying for their group's policy position (Berry, 2010).

Typically, urban sustainability research use proxies for interest group presence where the value of the manufacturing sector (e.g., Koski and Lee, 2014), counts of manufacturing establishments (e.g., Sharp, Daley, and Lynch, 2011), or combined measures of Chamber of Commerce members and developers represents industry group strength (e.g., Daley, Sharp and Bae, 2013; Schumaker, 2013). While this approach is appropriate when interest groups are control variables and not the focal predictor, it neglects the variation of interest groups that are active in specialized issue domains. Consequently, estimates of interest groups effects on sustainability policy adoption are widely varied. For example, in a study on local-level green building (buildings, not policies), Lee and Koski (2012) found statistically significant effects of manufacturing presence (as a proxy for industry interests) on counts of green buildings in cities (p. 616). In studies on broader sustainability policies, Berry and Portney (2013) did not find statistically significant effects of interest groups on local-level sustainability policies that apply to *privately*-owned buildings. Contrarily, Hawkins and Wang (2013) find that involvement of businesses in policy adoption processes has a statistically significant positive effect on the number of sustainability policies adopted by cities. Empirical results are somewhat inconclusive on the effects of business interest groups on local green building policy adoption.

Building for a New Economy (Support for Policy Adoption)

Green building policies for public buildings have particular impacts on the construction industry. In the "political market" (Feiock, Tavares, and Lubell, 2008), business interest groups may seek green building policy change for economic gain and support governments' decisions to adopt green building policies, particularly when using governments' own buildings (Hawkins and Wang, 2013, p. 65). Interest groups representing green construction may view governments' willingness to construct buildings to green standards as an opportunity to shift the market and increase demand for green construction in the private sector (Berry and Wilcox, 2009, p. 28-31; Volokh, 2003).

Green builders can gain market advantages by participating in energy efficient and green building policy processes. Industry actors can participate in a voluntary way, offering to help shape the guidelines (May and Koski, 2007) and bidding for contracts with the government as a way to learn new green building practices before the demand for green building increases. Firms experience the benefits of participating in advancing energy and green building policies as a way to differentiate themselves in the marketplace as the policies evolve to start regulating privately-owned buildings (Cotton, 2012) or strive to marry economic development and environmental protection such as in Smart Growth policies (Portney, 2013). Moreover, firms generally want their stakeholders (clients and investors) to view their business as supportive of the environment and public interests (Bansal and Roth, 2000; Darnall, Potoski, and Prakash, 2010).

H1 (Supportive): Higher numbers of green construction interest group members per capita are likely to increase the probability of the adoption of green building mandates.

Building as Usual (Opposition to Policy Adoption)

Drawing from the economic and political theory of the firm (March, 1962), business interest groups seek to maximize their profits in the short and long runs and therefore oppose public policies that impose higher cost burdens (Coase, 1936; March, 1962; Spulber, 2007). In classical economics, profit maximization is determined by the production function, cost function and price (March, 1962, p. 668.) New green building regulations increase costs while price movement remains uncertain. It is unknown to builders whether the customer will pay a higher price for the building. Following March's (1962) perception of business as a political coalition, firms are expected to form interest groups towards the goal of conflict resolution, and their conflict resolution strategy is expected to be stable and meaningful. The stable and meaningful approach to conflict resolution for traditional construction associations when it comes to regulations on buildings has historically been a long-standing policy position of anti-regulation, tolerating voluntary involvement in green building but not mandatory prescriptive requirements. The business sector generally prefers less government regulation and more voluntary programs, such as financial incentives (Kamieniecki, 2006).

Business interest groups may oppose green building policies, even those that apply only to government buildings, for at least two reasons. First, the policy signals a market shift opening doors to subsequent regulation requiring construction practices that can be costly and therefore disadvantageous to maximizing profits. Many industry actors view regulations on public facilities as a slippery slope for mandates on private buildings (Bae, 2014; Levmore, 2010; May and Koski, 2007, p. 53). Any adoption of green building policies and programs may be viewed as an endorsement of green building ideals, paving the way for subsequent mandatory regulation that the traditional construction industry would ultimately oppose (Levmore, 2010). Further, market actors may negotiate with policymakers taking the stance that additional regulations are unwarranted because the industry professionals have already integrated green building and energy efficient construction practices into their businesses under a voluntary program (Kamieniecki, 2006). Second, the policy change may grow the market for their competitors who specialize in green construction (Levmore, 2010). In a finite construction industry, the total capital available for construction is limited. Construction industry professionals who do not expand into green building markets could be crowded out by professionals with modernized, green building skill sets (Levmore, 2010).

H2 (Oppositional): Higher numbers of traditional construction interest group members per capita are likely to limit the probability of the adoption of green building mandates.

Background on the LEED Program

The LEED green building program was developed in 2000 by the U.S. Green Building Council (USGBC), a 501(c)(3) non-profit organization founded in 1993. Continually developed through a consensus-based decision-making process (USGBC, 2017c), the program details prescriptive requirements and environmental performance standards for the design and construction of buildings and development projects, and more recently expanded to provide standards for neighborhoods and cities. Initiated in the United States, LEED is used in over 160 countries with over 30,000 certified projects worldwide (Shutters and Tufts, 2016). While the program was originally used voluntarily by construction industry professionals, it has increasingly been adopted by governments as a mandatory policy (Schindler, 2010).

The LEED program has four levels of certification: Certified, Silver, Gold and Platinum (USGBC, 2017c). Building professionals can apply for certification based on the total number of points that the project attains, in addition to meeting minimum program requirements such as project size requirements. Points can be achieved in the areas of energy or water efficiency; site and land use development; location and transportation; indoor air quality; and sustainable materials and resources. To receive project certification, the project team must apply to the USGBC with the appropriate project documentation and registration and certification fees. Fees associated with the program vary by LEED program type and project size with registration fees starting at $1,200 and minimum fees for building design and construction certification between $2,850 and $27,500 depending on project size (USGBC, 2019). The USGBC Trademark Policy allows project owners to market their buildings as “LEED registered” or “LEED certified” based on if the building has only been registered or actually completed the certification process (USGBC, 2018c).

Research Design

Case Selection and Dependent Variable

This study focuses on policies that require LEED certifications for city-level public and privately-owned commercial buildings, not market incentives such as expedited permitting or fee reductions. Only LEED certification policies are examined because industry groups are not expected to oppose policies for financial incentives or goal-setting, as those types of policies do not impose cost burdens to industry. The dependent variable is dichotomously coded for whether or not a city has adopted a certification policy. The source of this data comes from the Public Policy Library of green building requirements for cities, counties, states and federal government buildings maintained by the USGBC beginning in 2017 (USGBC, 2017b, 2018b). Two hundred and seventy-nine cities have a LEED certification policy for public and/or privately-owned commercial buildings, including schools (USGBC, 2018b; Figure 4-1). California has the most local level green building policies, many of which are local adoptions of the state-level California Green Building Code to replace existing municipal requirements or amend the state code with local requirements.

[Insert Figure 4-1 Here]

Focal Independent Variables

The focal independent variables are counts of 'traditional' and 'green' construction industry interest group members normalized by the total number of construction workers in the city. The 'traditional' interest group variable is comprised of members of the Building Owners and Managers Association (BOMA). The 'green' interest group variable is constructed from the publicly-available USGBC member list (USGBC, 2018a). There are 5,648 BOMA members in 1,480 communities and 50,336 USGBC members in 6,301 communities. To give a sense of how construction professionals in a community relate to the total population, in New York City and Kansas City, approximately 2 percent of the total population, or 196,634 and 11,473 people, respectively, works in the construction industry using American Community Survey estimations. Nationwide, BOMA and USGBC members represent a mean of 0.2 and 0.5 percent of the construction industry, respectively. New York City has 570 BOMA members and 2,098 USGBC members. Kansas City, MO has 98 BOMA members and 285 USGBC members.

The Washington, D.C.-based USGBC has a decentralized advocacy model where regional and local chapters have members, as well as paid staff, who provide local technical support and professional green building services and advocate for green building, which are core benefits of member association (Koski, 2010, p. 102; USGBC, 2019). USGBC members represent a variety of professions and sectors, including product manufacturers; contractors and builders; corporate and retail; education and research institutions; environmental and other 501(c)(3) nonprofit organizations; governments; finance and insurance; professional firms; trade associations; real estate professionals; and energy service providers (USGBC, 2017a). Members are granted access to an extensive library of resources, educational courses, and can market themselves in the membership directory (USGBC, 2019).

BOMA is also an organization with local chapters. Clearly stated in BOMA's policy positions statements,

> "BOMA International does not support the adoption and implementation of green/sustainable building codes intended to apply to all newly constructed buildings, or to all tenant finish-out, additions and major renovations to existing buildings…" (BOMA, 2018).

Based on their explicit policy position, it is expected that BOMA's presence in a community will limit the likelihood of pushing a green building policy agenda forward. To gather counts of BOMA members per city, I used the Python programming language and the PDFMiner library to convert the 2018 BOMA Member Directory PDF to plain text. Then I found all city and state combinations in the text, and aggregated the counts of members in each community (BOMA, 2018; Shinyama, 2016).

Ideally it would be possible to construct a pooled cross sectional dataset with counts of all construction sector interest group members for each city in each year, but I was limited by time and resource constraints for data collection. Consequently, only the most dominant interest groups in commercial building policy processes – BOMA and USGBC - are represented in this research.

Political and Community Characteristics (Control Variables)

Political Institutions. Various forms of government, such as mayor-council or council-manager structures, are expected to influence several aspects of policy processes such as interest group engagement during agenda-setting and policy adoption (e.g., Bae and Feiock, 2013; Hawkins, Krause, Feiock and Curley, 2016; Sharp, Daley and Lynch, 2011). Mayor-council forms of government are expected to be susceptible to the influences of dominant interest groups. These executive arrangements are associated with an emphasis on short-term political gains and political alignment with powerful groups. In contrast, council-manager forms of government tend to be more responsive to technical experts. These government types are thought to have a longer-term outlook with the primary interest of maximizing operational efficiency and ease of policy implementation. These government types are more likely to host stakeholder engagement activities so that a diverse interest groups can help to shape public policies (Bae and Feiock, 2013; Daley, Sharp and Bae, 2013; Krause and Douglas, 2005). The political institutions variable is dichotomously coded for mayor-council (1) or other form of government such as council-manager (0) using data from the International City Management Association (ICMA) Municipal Yearbook and collected directly from city websites where data is not found in the yearbook.

Climate Commitment. In addition to the institutional structure, the city's commitment to climate protection is likely to influence the adoption of green building policies. As it relates specifically to climate protection, a combined measure of two indicators are used to construct the climate commitment variable: a dummy code if the city's mayor is a signatory of the Mayor's Climate Protection Agreement or if the city is a member of ICLEI Local Governments for Sustainability (1), otherwise 0. Additionally, California is included as a dummy variable in these models because it has been a leader in green building policy advancement with a statewide green building code that cities adopt locally. Almost 30 percent of localities with LEED certification policies in this study are in California.

Government and Industry Capacity. In most cities, the city planning and building department relies on general revenue and/or development permit fees to fund government staff to implement buildings policies. Thus, general revenue per capita for each city is used as a measure of government capacity for adopting new building policies, as building permit fee data is not available. Overall, cities with struggling economies may have less demand for mandatory green building requirements than a thriving city that is working to manage excessive growth. Further, cities need funding from general revenue or permit fees to manage the transaction costs, such as training industry members on new building practices, associated with new green building regulations (Nelson, 2012).

City Characteristics and Socioeconomic Conditions: Population, Income and Education. Cities with larger populations have been found to be more likely to adopt LEED policies due to having more resources, such as government staff to implement the policy (Cidell and Cope, 2014, p. 1774; Kontokosta, 2011, p. 75). The size of the construction industry highly correlates with population (0.95), so population logged is included in the models to retain consistency with many other policy adoption studies. Further, counts of housing units highly correlates with population (0.99) and was explored but is not used in these models. People with higher education tend to have higher incomes, which in turn typically results in a higher tax base to support government initiatives. The percentage of the population with a Bachelor's degree or higher as well as median household income for each city are included in the model.

Problem Severity. Cities with very little building activity may be less likely to adopt modern building policies than cities with more construction activity. The median age of housing in a city is used as a proxy to represent the building stock in the models. Older median housing age is associated with less current building activity and a newer median housing age correlates with higher levels of recent construction activity. Further, the average electricity cost in the county is also used as a proxy for problem severity, as places with more expensive energy are likely to seek buildings policies that reduce energy usage to lessen the economic burden of building operations. Where county-level electricity costs is not available, I use the average electricity cost for the state.

All Census variables were collected using the Python program, CenPy, which enables the retrieval of Census data tables into Python for data processing (e.g., formatting, joining tables) (Wolf, 2018). Table 4-1 shows the descriptions and variables for all data sources.

[Insert Table 4-1 Here]

Rare Events Logit Model and Discussion on Modeling Results

I use rare events logit modeling to estimate the probability of LEED certification policy adoption given differences in the presence of trade association members across cities (King and Zeng, 2001). This modeling technique resamples the data to run regression simulations with all values of policy adopters in each simulation. I selected this method because of the sparse number of cities that have adopted LEED certification policies (277 cities, or 1.4 percent of cities in the sample). In order to understand patterns in adoption, I use a dataset of permit issuing places for information on non-adopters. Of the 20,100 permit issuing places in the U.S., 19,579 places have sufficient data to be included in the statistical models. I use the Zelig library ReLogit class in the R statistical computing program for modeling (Choirat et al., 2018).

For greatest explanatory power, I developed a full model that includes cities with LEED certification requirements for privately and publicly owned buildings. Next, I explore how the effects shift depending on whether the policy applies to privately owned buildings or publically owned buildings by modeling these two population subsets separately. Each model has 19,579 cities that are bootstrapped, or resampled using the rare events logit method. The first model has 277 cities that mandated LEED certification for any building type. The second model has 104 cities that adopted LEED certification mandates for public buildings. The third model has 125 adopting cities with mandates for privately owned commercial buildings (Table 4-3). The full model has the most explanatory power with an R^2 of 0.13. The public and commercial models have an R^2 of 0.07 and 0.06, respectively.

[Insert Table 4-3 Here]

Across all models, green interest group presence matters for LEED policy adoption. It is not surprising that green interest groups – operationalized by counts of USGBC members per 1000 people – is important since the USGBC is the creator of the LEED program and has local association members advocating for policy adoption. This reflects the openness of local political systems where local business interest groups can effectively influence government policy. It also shows how powerful an industry association can be when they develop a voluntary program that gains such widespread attention and legitimacy that governments begin to adopt it as a mandatory requirement. Holding all other independent variables at their means, a one standard deviation increase in green interest group presence increases the city's odds of LEED certification policy adoption by 14 percent in the full model and 4 to 6 percent in the public and commercial models (Table 4-4).

[Insert Table 4-4]

Figure 4-2 shows a less linear relationship between green building policy adoption and the traditional construction industry compared to the green construction industry. The traditional interest group is not significant and the effects are very small (-0.001 or less). This could be explained as traditional builders not viewing green building construction as their target market, and LEED policies being more heavily targeted at public buildings. The commercial building model attempts to isolate policies that regulate privately-owned commercial buildings, but these policies could be relatively weak and builders may be able to easily meet the LEED-certified requirements in some markets depending on state and local building code stringencies, rebate programs for energy and water efficiency, and urban design of the cities could make LEED credits such as proximity to public transit more easily attainable.

[Insert Figure 4-2 Here]

As expected, the political institutional structure and climate commitment are consistent with urban policy theory. Cities with mayor-council forms of governments are more likely to adopt green building policies. Not surprisingly, the most impactful indicator is whether the city has made a commitment to climate protection as a signatory of the Mayor's Climate Protection Agreement or member of ICLEI. Cities are 13 percent more likely to adopt LEED certification requirements when they have committed to climate protection. Similarly, given the strong state commitment to green building, cities within California are more likely to adopt LEED certification requirements.

While population is significant across the models, the odds ratio of 1 signifies that there is not a substantive difference between cities that adopted or did not adopt LEED certification policies on this characteristic. The varied population sizes of cities adopting LEED requirements could be explained by the outsourced nature of LEED where a third party – the USGBC – and their members are doing most of the program management and document preparation for the program, alleviating the administrative burden to the government. This could also be why general revenue is not a significant indicator of policy adoption.

I had expected that communities with higher educational attainment and income would be more likely to have LEED certification policies. This expectation is met for education but not income. A one standard deviation increase in education increases the city's odds of policy adoption by 7 percent. Income is not significant, which is not surprising since it is a measure of household income whereas LEED building policies typically effect commercial real estate and not residential. I had also expected that higher energy costs and newer building stocks to be likely to increase the odds of policy adoption. While energy cost and housing age have negative coefficients, the odds ratios are 1 indicating that there is no significant difference between adopting and non-adopting cities.

As illustrated by the statistical modeling in this study, the ability to identify distinctive motivations within a type of interest group can help explain how distinctive segments within a business interest effect urban policymaking differently rather than treating business interests as the same across the sector. The traditional industry association had a negative effect on LEED policy adoption while the green industry group had a positive effect, similar to findings in May and Koski (2007). These groups both represent the construction industry, yet have very different effects on LEED certification policy adoption.

In line with the microeconomic theory that firms are profit maximizers and will seek market differentiation to secure profits, the green industry association members are well-positioned to absorb the new market for green building that is grown by city policy adoption compared to their traditional peers who have not distinguished themselves as having green building expertise. The green industry association members may be ideologically motivated, realizing that firms can obtain substantial profits while also supporting environmental protection, or they may just be strategic profit maximizers motivated to get a share of a new untapped market. Either way, this study shows that their presence increases the likelihood of green building policy adoption unlike their traditional peers.

Regarding effects of the control variables, many were statistically significant but had odds ratios of 1, indicating no apparent difference between cities with or without LEED certification policies. LEED certifications are most common for commercial buildings, particularly office buildings, so demographic variables might be representing latent concepts such as urban development patterns involving concentrations of office parks and surrounding residential developments, or diverse urban core development patterns in these cities and towns. Controlling for city characteristics that characterize local commercial real estate markets, such as number of office buildings in the city or the competitiveness of the local office rental market, might provide a better fit for modeling LEED policies, but this data is not readily available unless purchased from CBRE, a company that sells commercial real estate data for local markets.

A limitation to this study is that it explores only two industry associations of many groups that are involved in influencing building-related policy adoption. I attempted to select the most distinctive and influential groups, but without surveying government staff and political leaders or counting testimonies from public hearings it is difficult to validate the selection of the two groups. The USGBC is an obvious choice as it is the organization that developed LEED. BOMA is known to be highly influential and oppositional in building-related policy adoption processes, according to expert knowledge and their explicit oppositional policy statement cited earlier in this paper. Other groups are also influential, though. An article on why some industry groups are trying to ban green building standards (Badger, 2013) points to the American High-Performance Buildings Coalition (AHPBC) as an industry-led coalition opposing LEED (AHPBC, 2018a, 2018b). The 42 coalition members listed on the AHPBC website are product-oriented councils and associations, each with their own membership populations. The Coalition supports "reasonable *performance based* policies" and "*voluntary* adoption" similar to BOMA's policy position statement. A subsequent study could model the sums of members in the 42 industry groups for an estimation of their effects on mandatory green building policy adoption at the local level.

Conclusion

The green building policy arena allows for a careful examination of the role that business interests play in the adoption and diffusion of sustainability policies at the local level. This research segments interest groups that represent a major industry (construction) by isolating traditional and green building interests in order to examine interest group behavior in sustainability policy adoption in more detail. Contributing to sustainability research, isolating business interest groups into distinct segments is conducive to explaining effects on urban policymaking with greater nuance than the more commonly taken empirical approach that treats business interest groups as one unit.

In this study, the presence of green building interest group members matter to LEED policy adoption, increasing the odds of LEED policy adoption by up to 14 percent, while the traditional building interest group had very little influence. It is not surprising that the USGBC industry group supports LEED policy adoption as the group is expected to gain a market advantage from the policy change. It is, however, surprising that the presence of traditional construction industry group members does not have a significant negative effect on LEED certification policy adoption as private industry is expected to reject mandatory regulations due to potential effects of the new construction practices cutting into profits and the policy change growing the market for their competitors.

The policy's target population – public or commercial buildings – was not a distinguishing factor in this study, but theoretically the policy scope is expected to be an important consideration as construction industry groups are expected to be more likely to support policies that regulate public buildings than private buildings due to who pays the incremental cost for green construction. More research is needed that isolates policies that apply to public and commercial buildings to determine the conditions under which the policy scope matters.

A city's commitment to climate protection increases the odds of LEED policy adoption by 13 percent, indicating the strong relationship between urban sustainability goals and green building policy strategies. This study deviates from broad sustainability research by examining the types of interest groups that are active in the green building sector of sustainability. This is an important approach because each aspect of sustainability has distinctive interest groups that participate, and so treating sustainability as a broad concept misses the nuances of each policy domain within it. As the urban sustainability field grows, more acutely examining specific sectors will facilitate a better understanding of the actor groups that are influential urban sustainability policy processes.

Tables and Figures

Figure 4-1. Count of LEED Certification Policies in this Study (n = 277 cities)

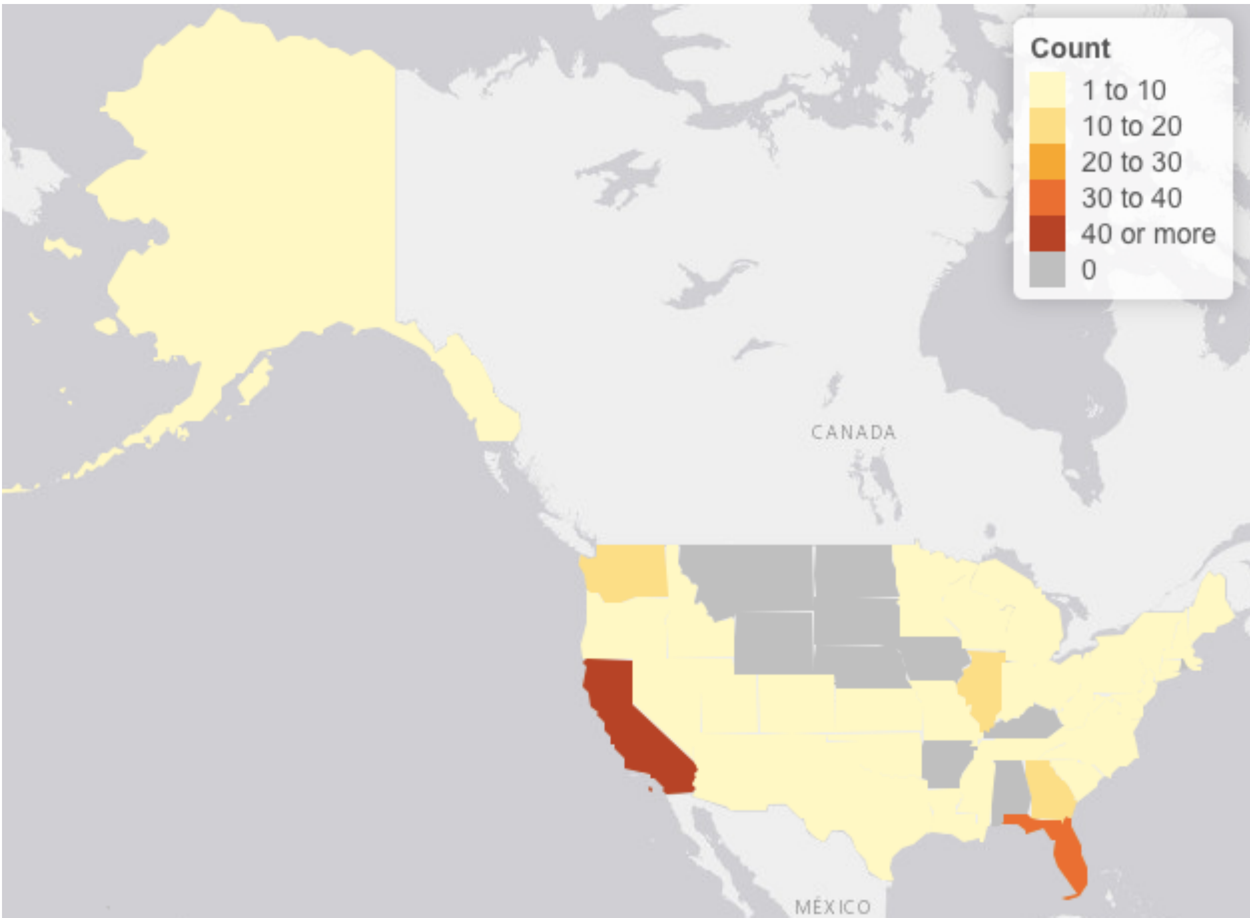

Table 4-1. Variables, Descriptions, and Data Sources for Green Building Models

Variable	Description
Dependent Variables	
Policy adoption or non-adoption	Adoption of LEED certification requirements for any buildings; commercial buildings only; public buildings only; or non-adoption. Source: USGBC database, 2018; U.S. Census, 2017
Interest Groups (Focal Predictors)	
Green business interest group	Number of USBGC members in each city normalized by the total number of construction workers in the city. Source: USGBC member list, 2018
Traditional business interest group	Number of BOMA members in each city normalized by the total number of construction workers in the city. Source: BOMA directory, 2018
Political and Community Characteristics (Control Variables)	
Political: Institutions and Ideology	
Form of government	Dichotomous variable for city that has a mayor-council form of government (1) or other form of government (0). Source: ICMA Survey, 2011
Climate commitment	Dichotomous variable for city that is a signatory of Climate Protection. Source: U.S. Conf. of Mayors, 2018; ICLEI, 2018Agreement or ICLEI member
California	Dichotomous variable for city that is located in California
Government and Industry Capacity	
General revenue	Per capita general revenue for each city ($1000s). Source: Census of Governments, 2012
City Characteristics and Socioeconomic Conditions	
Population	Logged population of each city. Source: 2016 American Community Survey, 5 Year Estimates
Income	Median household income ($1000s). Source: 2016 American Community Survey, 5 Year Estimates
Education	Percent of population over age 25 with Bachelor's Degree or higher. Source: 2016 American Community Survey, 5 Year Estimates
Problem Severity	
Energy cost	Average cost of electricity (kWh) in each county. Where county data is not available, average cost in the state. Source: Energy Information Administration, 2017
Median housing age	Median age of housing stock in the city. Source: 2016 American Community Survey, 5 Year Estimates

Table 4-2. Descriptive Statistics for Green Building Policy Adoption Models

	No Policy n = 19,302			Adopted Policy n = 277		
Statistic	Mean	Min	Max	Mean	Min	Max
Green interest group	0.004	0	2	0.03	0.00	0.53
Traditional interest group	0.002	0	19	0.01	0.00	0.29
Form of city government	0.14	0	1	0.25	0	1
Climate commitment	0.04	0	1	0.60	0	1
California	0.02	0	1	0.30	0	1
General revenue	1.61	0.00	953.24	2.43	0.37	80.17
Population	7.19	0.00	14.26	10.91	6.91	15.95
Income	48.56	0.00	250.00	72.46	19.52	243.70
Education	0.13	0.00	1.00	0.25	0.07	0.49
Energy cost	10.97	1.79	39.36	12.59	2.18	27.55
Housing age	1966	1939	2016	1972	1939	2004

Table 4-3. Rare Events Logit Results from Modeling Green Building Policy Adoption

	Dependent variable: LEED Certification Policy Adoption		
	Full Model	Public Model	Commercial Model
Green interest group	0.13^{***}	0.04^{***}	0.06^{***}
	(0.02)	(0.02)	(0.02)
Traditional interest group	-0.0004	-0.001	-0.001
	(0.01)	(0.004)	(0.004)
Form of city government	-0.01^{***}	-0.01^{***}	-0.01^{***}
	(0.002)	(0.002)	(0.002)
Climate commitment	0.12^{***}	0.06^{***}	0.05^{***}
	(0.004)	(0.003)	(0.003)
California	0.10^{***}	0.03^{***}	0.04^{***}
	(0.01)	(0.003)	(0.004)
General revenue	0.0000	0.0000	0.0000
	(0.0001)	(0.00)	(0.00)
Population	0.01^{***}	0.003^{***}	0.003^{***}
	(0.001)	(0.0003)	(0.0004)
Income	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Education	0.06^{***}	0.02^{***}	0.03^{***}
	(0.01)	(0.01)	(0.01)
Energy cost	-0.0002	-0.0003^{*}	0.0001
	(0.0003)	(0.0002)	(0.0002)
Housing age	-0.0001^{***}	-0.0001^{***}	-0.0001^{**}
	(0.0001)	(0.0000)	(0.0000)
Constant	0.21^{**}	1.20^{***}	1.14^{***}
	(0.10)	(0.06)	(0.07)
Observations	19,579	19,579	19,579
R^2	0.13	0.07	0.06
Adjusted R^2	0.13	0.06	0.06
Residual Std. Error (df = 19567)	0.11	0.07	0.08
F Statistic (df = 11; 19567)	269.09^{***}	123.74^{***}	111.96^{***}

Note: Standard errors in parentheses $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 4-4. Odds Ratios for Green Building Policy Adoption Models

	Dependent variable: LEED Certification Policy Adoption		
	Full Model	Public Model	Commercial Model
Green interest group	1.14***	1.04***	1.06***
	(0.02)	(0.02)	(0.02)
Traditional interest group	1.00	1.00	1.00
	(0.01)	(0.004)	(0.004)
Form of city government	0.99***	0.99***	0.99***
	(0.002)	(0.002)	(0.002)
Climate commitment	1.13***	1.06***	1.06***
	(0.004)	(0.003)	(0.003)
California	1.10***	1.03***	1.04***
	(0.01)	(0.003)	(0.004)
General revenue	1.00	1.00	1.00
	(0.0001)	(0.0000)	(0.0000)
Population	1.01***	1.00***	1.00***
	(0.001)	(0.0003)	(0.0004)
Income	1.00	1.00	1.00
	(0.0000)	(0.0000)	(0.0000)
Education	1.07***	1.02***	1.03***
	(0.01)	(0.01)	(0.01)
Energy cost	1.00	1.00*	1.00
	(0.0003)	(0.0002)	(0.0002)
Housing age	1.00***	1.00***	1.00**
	(0.0001)	(0.0000)	(0.0000)
Constant	1.23**	3.32***	3.13***
	(0.10)	(0.06)	(0.07)
Observations	19,579	19,579	19,579
R^2	0.13	0.07	0.06
Adjusted R^2	0.13	0.06	0.06
Residual Std. Error (df = 19567)	0.11	0.07	0.08
F Statistic (df = 11; 19567)	269.09***	123.74***	111.96***

Note: Standard errors in parentheses *p<0.1; **p<0.05; ***p<0.01

Figure 4-2. Marginal Effects of Interest Groups on Predicted Policy Adoption

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Chapter 5 Interest Groups, Policy Impacts, and Advocacy Biases

Abstract: This study explores the nature of information that is shared by various organizations in the context of the green building program, Leadership in Energy and Environmental Design (LEED). It tests two competing hypotheses – advocacy bias and interest group professionalism – to identify if there is systematic variation across published studies on energy savings from LEED-certified buildings. Using a meta-regression methodology, I find that studies that have an environmental organization as the primary author are likely to report higher levels of energy savings from LEED buildings when compared to studies that have government agencies or universities as the primary author. Based on results of a paired t-test, LEED buildings use an average of 14 percent less site energy use intensity than non-LEED buildings.

Keywords: *interest group, information sharing, advocacy bias, green building, LEED*

Introduction

The amount of energy that buildings consume is a critical aspect of urban sustainability and an important part of the solution for climate change mitigation. The buildings sector accounts for 32 percent of the world's energy use and 19 percent of global energy-related greenhouse gas emissions (Lucon et al., 2014). There are many opportunities to reduce energy consumption in buildings, including increasing insulation, reducing air infiltration, and installing energy efficient lighting and climate control systems. The term 'green' building has been coined to exemplify these types of opportunities, in addition to reducing water use, improving land use, accessing alternative transportation, and building with sustainable materials. Environmental activists and policymakers have been optimistic of the potential effects of building 'green' under the worldwide green building program, Leadership in Energy and Environmental Design (LEED). While many studies on LEED-certified buildings have found that green buildings use less energy than conventional buildings (e.g., Newsham, Mancini, and Birt, 2009), other studies have found that LEED does not always achieve reductions in energy use (e.g., Scofield, 2009, 2013b). In some cases, LEED buildings use *more* energy than comparable conventional buildings (e.g., Scofield and Doane, 2018). As an example, a study on three LEED certified schools found that the LEED schools used 17 percent more source energy than other schools (Scofield and Doane, 2018). The major issue has been that LEED is designed for flexibility: building professionals can choose to earn points across multiple categories, and until recently the buildings did not have to meet minimum energy requirements aside from compliance with local building codes. The resulting uncertainty about LEED's impacts have been widely expressed across many mediums, including news media (Navarro, 2009), blogs (Lstiburek, n.d; Stephens, 2013), technical studies (New Buildings Institute, 2008), magazines (Swearingen, 2014) and peer-reviewed articles (Kern et al., 2016; Scofield, 2009, 2013; van der Heijden, 2015). Given that cities adopting LEED standards are relying on lower environmental impacts from green buildings to meet their climate change mitigation goals, it is important to understand why evaluations of energy consumption are so drastically varied across studies.

A range of factors could explain the discrepant results across LEED evaluations. This paper is particularly interested in the identity and impact of authors' affiliations as it relates to interest group advocacy. Authors' affiliations represent interest group dynamics of information sharing with policymakers. The authors' affiliation in an interest group is expected to influence important features of the study design, including case selection and framing of the story. Indeed, some authors are affiliated with advocacy organizations whose mission is to promote green building. Of the published studies that estimate the change in energy use from LEED certified buildings, are some organizations who have analyzed LEEDs' effectiveness presenting higher or lower energy savings than other types of organizations? More directly, do environmental groups report higher energy savings from the program compared to authors who are affiliated with academic institutions? In other words, is there an advocacy bias in green building energy consumption analysis? I also explore other important factors that could explain variation in energy outcomes, including if the evaluations were conducted using field testing or modelling simulations, use site or source energy as the energy unit analyzed, and the building types included in the analysis.

Regarding author affiliation and informational lobbying, this research tests two competing theories on interest groups and the information that they release: advocacy bias and interest group professionalism. *Advocacy bias* refers to written communication that is intentionally constructed by interest groups to align with particular policy preferences (Ainsworth, 2010; Barnes and Bero, 1990; Fischer, 1990, 2003; Fischer and Forester, 1993; Fischer and Gottweis, 2012; Lopipero et al., 2007; Potters and van Winden, 1992; Shanahan, Jones and McBeth, 2011; Weible and Sabatier, 2007; Weible, 2008). In contrast, *interest group professionalism* posits that interest groups strive to create accurate and honest written material so as to maintain trust, credibility, and reputability with policymakers (Ainsworth, 2010; Berry and Wilcox, 2009; Koski and May, 2006; Lopipero et al., 2007). The duality of interest group pressures in terms of advocacy bias and reputational interests are explored throughout this study.

The paper proceeds as follows. First, I discuss advocacy bias and interest group professionalism in more detail, leading to hypotheses about the relationships between author affiliation and reported energy consumption of LEED buildings. Next, I provide background information on the LEED program. Then I present the research design, which centers around the meta-regression method, a generalized linear regression model on study characteristics obtained through the meta-analytic process of extracting data from documents. I describe the variables used in the models and explain the meta-regression method in detail. Next, I discuss results of the model suggesting that environmental interest groups report higher energy savings than studies with government or university-affiliated primary authors. Finally, I conclude with connecting the research findings to broader literature and policy implications.

Theory and Hypotheses

The game theoretic foundation for this study postulates the occurrence of information asymmetry between policymakers and interest groups as policymakers need expert information from interest groups, but do not know the extent to which the information provided is biased towards the interest groups' ideological preferences (Koski and May, 2006; Martimort and Sememov, 2007; Potters and Winden, 1992). Information sharing is one of the core functions of interest groups in policy settings (Lopipero et al., 2007). Interest groups tend to advocate for their beliefs to policymakers who hold similar beliefs, which keeps transaction costs lower than if they were to advocate to policymakers with incongruent beliefs (Potters and Winden, 1992). Interest group activity commonly occurs within a "village" type of environment where policymakers and advocates are well-known to each other (Berry and Wilcox, 2009, p. 103). While the policymakers' ideological biases are partially known to the interest group since the interest group knows how the policymaker has voted in the past, the interest group does not how the policymakers' stance might shift over time or where they stand on a particular policy issue, creating a game setting (Martimort and Sememov, 2007). The interaction between interest groups and policymakers occurs in a "repeated games" context, so while the interest group may want to only present information that is advantageous to their policy position, they also have long-term reputational interests to consider (Berry and Wilcox, 2009; Potters and Winden, 1992). Credibility is one of the most important characteristics of interest groups in their ability to gain trust from a policymaker (Berry and Wilcox, 2009, p. 103). Even still, information provided to policymakers can help shape policy decisions, raising the possibility of temptation for interest groups to provide information that only supports their policy preferences (Lopipero et al., 2007). These contrasting theoretical angles are broadly labeled "advocacy bias" and "interest group professionalism" (Table 5-1).

[Insert Table 5-1 Here]

Advocacy Bias

Organized interest groups have strategic incentives to disseminate information that is favorable to their policy position and to conceal information that is not favorable (Barnes and Bero, 1990; Lopipero et al., 2007; Potters and van Winden, 1992). An overarching concept is informational lobbying, defined by Potters and van Winden (1992) as "the use by interest groups of their (alleged) expertise or private information on matters of importance for policymakers in an attempt to persuade them to implement particular policies" (p. 269). Some of these informational dynamics are motivated by strategy, but much are explained by characteristics of organized groups where group members tend to interpret information that resonates with their beliefs and values, and to form organizations with other people with similar beliefs (Sabatier and Weible, 2007), as well as advocate to policymakers with similar beliefs (Potters and Winden, 1992). In political processes, people with similar beliefs form advocacy coalitions – a form of interest group – to act strategically to gain support for their policy beliefs (Shanahan, Jones and

McBeth, 2011; Weible and Sabatier, 2007; Weible, 2008). Organizations – like individuals – are likely to discount information that does not align with organizational values and goals. Consequently, "it is often thought that information from interest groups is hopelessly biased" (Ainsworth, 2010, p. 92).

Various strains of research provide theory and evidence of biases in information published by organized interest groups. While much of this literature takes a game theory approach due to the difficulties associated with this type of data collection, some of the research provides empirical evidence derived from qualitative analysis of written material (e.g., Lopipero et al., 2007; Olofsson, Weible, Heikkila, and Martel, 2017). Perhaps most extreme, well-known cases are tobacco companies denying the health effects of smoking (e.g., Lopipero et al., 2007). Among their many findings of advocacy bias, Lopipero et al. (2007) found that tobacco companies had administered public opinion surveys and only published results that supported their policy positions (p. 649). Another important body of research is narrative analysis where researchers identify patterns in written material that differently frame storylines depending on author affiliation (e.g., Jones, 2014; Olofsson, Weible, Heikkila, and Martel, 2017; Shanahan, Jones and McBeth, 2011). Interest groups tend to frame policy issues in ways that strengthen the interest groups' own policy positions and villainize their opponents (Olofsson, Weible, Heikkila, and Martel, 2017; Shanahan, Jones and McBeth, 2011).

A myriad of policy actors including researchers (e.g., Lstiburek, n.d.; Newsham, Mancini and Birt, 2009; Zuo and Zhao, 2014**;** Stephens, 2013; Scofield, 2009, 2013b) and news media (e.g., Navarro, 2009; Swearingen, 2014) have questioned whether LEED-certified green buildings consume more or less energy than conventional buildings, pointing at methodological concerns with various extant studies that claim energy savings. For example, the debate is captured by physicist Dr. John Scofield in the American Physical Society magazine article:

> "But do LEED-certified buildings actually save primary energy and reduce GHG emission? LEED certification has clearly captured the public's fancy–not unlike organic farming or herbal medicines. But also like these fields there is a woeful lack of scientific data supporting LEED's efficacy. *And what little measured building energy consumption data there are have been gathered through a "self-selected" process that is clearly biased towards the "better-performing" buildings.* In these data, proponents find evidence that LEED-certification is saving energy. But careful analysis of even these biased data show that LEED-certified buildings, with regard to primary (or source) energy consumption and GHG emission, perform like other buildings–no better and no worse."
>
> (Scofield, 2013a, italics mine)

Similarly, Lstiburek (n.d.) with the Building Science Corporation criticized the methodological approach used by the efficient buildings advocacy group, the New Buildings Institute, in their study of LEED buildings, a study that was commissioned by the USGBC. After discussing issues with the matching technique used to pair buildings, Lstiburek (n.d.) writes,

> "Someone had to play with the numbers to make the storyline work and that is just plain misleading….So what does this mean? Let us translate—the LEED buildings did not conclusively save any energy compared to typical buildings built at the same time. This is not good. LEED needs to be fixed. Manipulating a bunch of statistics to hide behind does not save any real energy."
>
> (Lstiburek (n.d.))

Explicit in these statements are essentially accusations of advocacy bias; interest groups are being accused of releasing information that solely supports their favored program while failing to account for methodological concerns to make the study credible. In this line of reasoning, the following hypothesis is conceptualized:

> H1: Studies authored by individuals affiliated with environmental interest groups are likely to report higher energy savings from LEED-certified buildings programs compared to other authors.

Interest Group Professionalism

From the pluralist viewpoint, the political system is a competition between diverse interest groups attempting to influence government (Dahl, 1961; Martimort and Semenov, 2007). In the competitive environment, opposing interest groups provide information to policymakers, and the relative consistency of that information is desired so that the policymaker has some degree of confidence in the information, and in turn, in the interest group (Bertrand, Bombardini and Trebbi, 2014; Lopipero et al 2007; Krishna and Morgan, 2001). If interest groups are to present inconsistent information, or otherwise mislead a trusted policymaker, their credibility could be diminished. In this regard, the competitive nature of political environments may foster interest group professionalism stemming from the need to maintain credibility with policymakers and other stakeholders (Lohmann, 1995; Martimort and Semenov, 2007). This assumption embraces the viewpoint of interest groups positioning themselves to be influential in the decision making process over a long-term time horizon in a “repeated games” setting where their interactions occur more than once and possibly on a variety of policy issues (Potters and Winden, 1992, p. 286).

Some political science literature on interest group behavior reflects the theory of interest group professionalism, resting on concepts of maintaining credibility and reputational interests (e.g., Berry and Wilcox, 2009; Hojnacki and Kimball, 1998). Credibility as a major asset in any political environment raises the possibility that information provided to policymakers by interest groups is constructed to be an accurate representation of a policy issue, albeit from the viewpoint of the interest group (Ainsworth, 2010; Berry and Wilcox, 2009, p. 103; Lopipero et al., 2007, p. 638-639; Potters and Winden, 1992, p. 286). More commonly, the political science field intrinsically embraces the polarization of ideologies and the resulting biases in information sharing (Contandriopoulos, et al., 2007), however some literature emphasizes the expertise of interest groups and their lobbyists and minimizes the discussion of informational biases. The notion that information shared by interest groups is not biased can be treated as the null hypothesis (e.g., Bertrand, Bombardini and Trebbi, 2014).

H2: Studies authored by individuals affiliated with interest groups are not likely to report statistically distinctive energy savings from LEED-certified buildings programs compared to other authors.

Background on the LEED program

The eco-labelling and design standards program initiated by the U.S. Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED) began in 2000. LEED has become a worldwide model program with a presence in over 160 countries and over 30,000 certified project worldwide (Shutters and Tufts, 2016). The certification program has four levels of stringency: Certified, Silver, Gold and Platinum. Building professionals who are seeking certification for the project can select from a variety of points from categories including energy, water, land use, transportation, indoor air quality and materials.

Until 2016, projects were not required to meet minimum energy efficiency requirements, other than the local building codes, but rather had to comply with minimum point requirements across multiple categories in order to be eligible for certification (USGBC, 2018b). This has caused a point of contention among the building community who wanted assurance that LEED buildings would use less energy than conventional buildings (e.g., Stephens, 2013). With recent program changes in 2016, now projects must meet minimum energy savings thresholds that depend on the type of project, or the project can qualify under an "above-code" prescriptive path that defines requirements beyond the minimum building standards (USGBC, 2018b). These characteristics of the green building policy domain create an ideal case selection to test advocacy bias and interest group professionalism, given that LEED policies have been diffusing worldwide yet the environmental outcomes from the program are still questionable. Mainly the critics are pointing to concerns with program design regarding minimum program requirements as well as concerns with biases in LEED research studies.

Research Design

This study uses a regression-based meta-analysis method to explore how authors who are affiliated with various organized groups or institutions report on energy savings from LEED buildings. Meta-regression methodologies have been prominent in fields that commonly use experimental research designs, such as medicine, because these studies tend to be more easily comparable relative to social sciences that use a myriad of analytical approaches (Ringquist, 2005, p. 224). More recently, the quantity of meta-regression studies has increased in the social sciences (Nelson and Kennedy, 2009), including public policy and public management, as new tools and techniques have become available (Ringquist, 2013). The benefits of meta-analysis methodologies is the ability to generate parameter estimates for variables of interest and to use tools to generalize statistical estimations across studies that use different methodologies and analytical approaches (Ringquist, 2013).

The *effect size* is the critical interest in a meta-regression study. Effect sizes are "standardized measures of the relationship between the focal predictor and the dependent variable in original studies" (Ringquist, 2013, p. 18), such as environmental regulation as the focal predictor and business location as the dependent variable (Jeppesen, List and Folmer, 2002) or income as the focal predictor and demand for water as the dependent variable (Dalhuisen, Florax and Rietveld, 2003). The intent of meta-regression studies is to estimate the effect size of a given phenomenon by combining models from a set of research studies. The approach to standardize the data depends on the type of statistical methods in original studies (e.g., regression, difference of means, etc.) and expectations of the data and relationships between variables.

Case Selection

The case selection includes all publically available studies on LEED-certified buildings obtained via a systematic review of extent literature (peer-reviewed and non-peer-reviewed), similar to methods used in other buildings-related energy efficiency meta-analyses (Delmas et al., 2013; Ankamah-Yeboah and Rehdanz, 2014). I searched the Google Scholar database using the following search settings: 1991-2018; keywords with Boolean operators: "energy use" AND "buildings" AND "Leadership in Energy and Environmental Design", retrieving 980 articles. I previously searched the EBSCO Host and Web of Science databases for the pilot study, retrieving 593 articles. For each paper that was retrieved in the initial sweep, I also downloaded "recommended" or "relevant" articles generated by the database during the article retrieval process. I assessed each article based on title and eliminated the article if the title explicitly states a focus on residential buildings or transportation, or some other unrelated topic, retaining only articles on relevant building types such as commercial and industrial buildings, resulting in 247 articles (Phase 1 in Table 5-2; see also Appendix Table 1: Codebook). Next, I read abstracts to determine if the paper is an empirical evaluation of the LEED program (Phase 2). Last, I evaluated each article to determine if the study estimates impacts of LEED construction on building energy use, resulting in a final sample of 22 articles (Final Phase).

[Insert Table 5-2 Here]

The sample size for this study is 22 unique articles containing 164 statistical models (Table 5-3). This study's sample size is comparable to other regression-based meta-analyses in education, agriculture, and water policy studies (e.g., Furnée, Groot, and van Den Brink, 2008; Bel, Fageda and Warner, 2012; Carvalho, Marques and Berg, 2012). For example, Furnée, Groot and van Den Brink, H. M. (2008) includes 35 studies with 64 statistical models in the first meta-regression model and 10 studies with 24 statistical models in the second meta-regression model. Bel, Fageda and Warner (2012) include 27 studies with 46 statistical models in the meta-regression. Carvalho, Marques and Berg (2012) include 35 studies in one meta-regression model and 13 studies in the other meta-regression model.

[Insert Table 5-3 Here]

The studies in the sample range from having only 1 LEED building to up to 254 LEED buildings in their difference of means models. Energy evaluations on LEED buildings are commonly undertaken in the architecture and engineering disciplines seeking to understand building performance - such as energy or water use intensity - of a small selection of buildings rather than reaching the broader goal of generalizing how much energy we can expect to save when building to LEED standards. Consequently, the population of LEED studies tend to suffer from very low sample sizes when considering the effect size from a statistical perspective rather than a building design perspective. This study attempts to aggregate results from the sample of LEED studies in order to discern an effect size estimate, in terms of Energy Use Intensity, across published studies.

Dependent Variable

The dependent variable is the percent change in energy use, representing the difference between the Energy Use Intensity (EUI) of LEED buildings compared to non-LEED buildings (Table 5-4). EUI is a common unit used when researchers normalize different fuel uses into one unit of energy, operationalized as energy per square foot per year (U.S. EPA, 2016). Analysts often use basic estimations to measure energy impacts for sustainability and energy planning purposes (Patton and Sawicki, 1986). For building energy consumption analysis, the following calculation is adapted from the EPA's recommendation:

$$\hat{y}_{energy\ savings} = ((\hat{X}_{subject} - \hat{X}_{baseline})\ x\ 100)$$

where $\hat{y}_{energy\ savings}$ is the impact of the program on energy consumption , $\hat{X}_{subject}$ is the energy usage of the LEED buildings, and $\hat{X}_{baseline}$ is the energy usage of baseline buildings that are not built to LEED standards (U.S. EPA, 2015). A convention in the energy efficiency program field is to report results in terms of percentage of energy savings. The formula is more basic than those used at the facility or building component level in engineering studies, which commonly use the International Measurement and Verification Protocol (Efficiency Valuation Organization, 2014) or ASHRAE Guideline 14 (ASHRAE, 2014), or other formulas for measuring impacts of a program on building energy consumption (Navigant Consulting, Inc. and Steven Winter Associates, 2015).

[Insert Table 5-4 Here]

Focal Predictor

From the perspective that persuasion towards favored policy positions is reflected in the published studies, the authors' affiliation becomes important. Author affiliation is the variable that represents the organizational affiliation of the study's primary author. I identified the authors affiliation in the journal articles' corresponding information about the authors, such as "University of X", or a name of a nonprofit organization. Authors are affiliated with environmental non-governmental organizations, government agencies or academic institutions. Each primary author is assigned to a category and coded as a factor variable. Table 5-5 shows descriptive statistics for all independent variables. Notably, none of the studies have businesses as the primary author and only one study has an environmental primary author affiliation.

[Insert Table 5-5 Here]

Controls

Multiple factors are expected to impact the building's energy use that is reported, including the method for measuring energy use, the type of energy that is analyzed, the building use type (e.g., hospital, data center, office building), and the number of buildings in the model.

Measurement method: modelling simulation or field testing. Some studies directly measure energy savings, while others estimate the savings using simulation. This is an important potential difference in the studies included in this research and could account for patterns in the dependent variable. A dichotomous variable indicating if the study uses modeling simulations or field testing is included in the statistical models.

Before a building is constructed, the engineer typically runs modeling simulations to estimate the energy consumption based on specifications of the building components. This information is compared to a baseline building constructed to model building codes which are minimum building standards with less efficient building system specifications, such as higher solar heat gain coefficients on the windows and lower energy efficiency ratings on the furnace. The difference between annual energy usage of the two buildings is the percent difference expected to be achieved by building to higher standards.

After the building is constructed, post-occupancy energy consumption data is available. However, LEED, as well as building codes, has not historically required post-occupancy energy consumption data to verify that the building is performing as it was designed. Some studies, however, are conducted using “field testing” methods, which analyze post-occupancy energy consumption data. In these cases, the energy consumption data is once again compared to some set of “baseline” buildings. Rather than a single building constructed to minimum building codes as the baseline like the method used in modeling simulations, researchers commonly use the Commercial Building Energy Consumption Survey (CBECS), a national dataset with energy consumption data for various building types as a way to compare energy usage in code-built buildings and LEED buildings.

The uncertainty and inconsistencies around modelling simulations and field testing could account for variation in the dependent variable. For example, Stoppel and Leite (2013) found that the modelling simulation over-predicted building energy use for two buildings by 14percent and 25percent. Schwartz and Raslan (2013) found that the use of particular simulation tool or statistical model used to estimate energy consumption significantly affected the energy estimations. There are many building scientists working to improve modeling simulations as well as people working to require post-occupancy evaluations in programs and building codes. The future outlook for this area of building science is promising, but for now these issues are likely to account for energy consumption discrepancies between studies.

Type of energy unit: site or source. The type of energy unit evaluated in the studies is also expected to explain some variation in the dependent variable (Scofield 2013b). Site energy is the amount of energy used by the building, seen as units of energy consumption on utility bills. Source energy is the true amount used by the building including the energy needed for generation, transmission, and production, i.e. the energy "losses" than never actually get to the building but instead get lost along the way. The EPA recommends using source energy units rather than site energy units in building analytics because it more accurately represents how much energy a building uses, accounting for the particular energy mix for the building since each fuel type has unique losses associated with it (EPA, 2016). Scofield (2013b) re-ran variations of the models that New Buildings Institute (2008) and Newsham, Mancini and Birt (2009) had produced, and found significantly less energy savings when source energy is calculated rather than site energy. Site energy is more commonly analyzed in building energy efficiency studies because site energy is reported on statements provided by utility companies so it is the easiest type of data for a consumer to obtain. Conversions between site and source energy can be done using the technical reference guide provided by the EPA through the Portfolio Manager program (EPA, 2018).

Building use type. Buildings perform differently based on how they are used. Some building use types, such as hospitals, data centers, and laboratories tend to use significantly more energy than other building use types, such as fire and police stations. Ideally, the number of observations in this study would be enough to dummy code each building use type. Given the small sample size of studies, buildings are grouped into three categories: 1) high energy building use types (hospitals, data centers, and laboratories), 2) building use types most affected by occupant behavior (office buildings), and 3) other building use types.

Number of buildings in the model. A common metric added to meta-regression models is the number of observations or degrees of freedom in the original study (Nelson and Kennedy, 2009; Ringquist, 2013). This construct is typically intended to address publication bias where peer-reviewed journals often prefer articles with statistically significant models and variables. Across the sample of LEED studies included in this study, the number of LEED buildings ranges from 1 building to 254 buildings.

[Insert Table 5-5 Here]

Data Analysis

First, I will address some problems associated with meta-regression modelling, including primary data heterogeneity, heteroscedasticity, and correlation caused when one study presents multiple analytical models (Nelson and Kennedy, 2009). Regarding heterogeneity, the dependent variable in the studies must represent the same construct across studies and the data cannot be so widely dispersed that the units are not on a single scale. Because this research is examining the effects of a program, variation in the dependent variable is highly likely. To get a sense of the variation between LEED and non-LEED buildings overall across the studies, I conducted a paired t-test on the means of site EUI of LEED and non-LEED buildings (Table 5-6). In many of the studies, the researchers used matching techniques to pair a set of baseline buildings to a LEED building. Using the paired t-test, each set of baseline and subject buildings are treated as a pair. The mean difference of site energy use of -14.16 percent rejects the null hypothesis that $H_0: \mu \neq \mu_0$, or the mean of the two groups is the same. This means that LEED buildings use less site energy overall. The upper and lower bounds of the 95 percent confidence interval are -26 percent and -2 percent, respectively, giving confidence that energy consumption for LEED buildings is less than non-LEED buildings overall. The t-ratio (2.36), representing the mean difference between the LEED and non-LEED buildings divided by the standard errors, indicates statistically significant differences between LEED and non-LEED buildings.

[Insert Table 5-6 Here]

To look deeper at the data, I created a boxplot to show the distribution of site and source EUI (Figure 5-1). The bottom and top of the boxes are the first and third quartiles, while the line in the middle represents the second quartile, or median. The median EUIs for the LEED buildings are visibly lower than non-LEED buildings. The whiskers represent the interquartile range (IQR) depicting the difference between the upper and lower quartiles of the data. The dots represent outliers. The source EUI boxplots have clear outliers while the site EUI is more evenly dispersed.

[Insert Figure 5-1 Here]

Because of the outliers shown in Figure 5-1, I created a second boxplot to identify if certain building types were chiefly responsible for the outlier data points, as outliers could over or underestimate the effect size (Figure 5-2). The most extreme data points are multi-family residential (which are considered commercial buildings in building codes and standards) and recreation building use types.

[Insert Figure 5-2 Here]

Next, I visualized the data in a scatterplot where the x-axis is percent change in site EUI and y-axis is the number of buildings in the study (Figure 5-3). The intent of the scatterplot is to help assess if models with single buildings or many buildings are showing the greatest or least change in energy use, as multiple techniques are used to mitigate such issues, such as weighting the model by number of observations in the original studies' model, or taking the mean effect size of all models per study (Nelson and Kennedy, 2009; Ringquist, 2013). The scatterplot shows that models with higher numbers of buildings are more scattered around 0 and models with one or very few buildings are widely dispersed along the x-axis. The positive and negative outliers are models of single buildings. This suggests that the number of buildings in the models are likely to have an effect on the dependent variable so a variable for the number of buildings is included in the model. As expected, most models reported decreases in site EUI for LEED buildings, but some models reported increases. To meet the assumptions of linear regression, I dealt with outliers in the dependent variable by capping the values at the 5th and 95th percentile.

[Insert Figure 5-3 Here]

Meta-regression Modelling Results

Using the R program for statistical computing, I produce a generalized linear regression model to estimate the effects of organized interests on reported energy savings while controlling for important study characteristics. I use the Metafor package, intended exclusively for meta-regression studies (Viechtbauer, 2010). The model uses standardized mean differences in energy consumption in LEED and non-LEED buildings as the dependent variable. The impact of each variable is the difference between the coefficient and intercept, or mean value of Y and reference category for the primary author factor variable, when all independent variables are equal to zero.

The intercept is -29 percent change in energy use between LEED and non-LEED buildings with “Government” author affiliation as the reference category (Table 5-7). Studies authored by an environmental organization report the highest mean energy reduction (-45.95 percent) of all the primary author categories when all other independent variables are equal to zero. Studies with a primary author that has a university affiliation reports the least energy reductions in LEED buildings (-14.60 percent, adding the university coefficient to the intercept).

[Insert Table 5-7 Here]

These results support the advocacy bias hypothesis suggesting that the environmental organization will report higher energy savings than authors affiliated with government agencies or universities. Looking closer at the distribution of reported energy savings by primary author category, it is clear studies with the environmental author affiliation mostly reports energy reductions, not energy increases, while the government and university affiliations report a wider distribution of energy consumption patterns (Figure 5-4). Studies with universities as the primary author affiliation especially have a high number of statistical models that find that LEED buildings use more energy than non-LEED buildings.

[Insert Figure 5-4 Here]

The measurement approach in terms of modeling simulations or field testing was expected to have an effect on the reported energy savings, as modeling simulations are notoriously inaccurate and field testing using actual energy bill data is more accurate. However, the lack of statistical significance suggests that the measurement approach is less clear-cut than expected ($p=0.29$). Overall, field measurements are expected to report -10.54 less energy consumption than modeling simulations. Considering that field measurements are considered to be more accurate, this finding suggests that, generally speaking, LEED buildings are using less energy when field tested than the modeling simulations are projecting.

Other control variables are intended to help fit the model. While the building use types variables are not statistically significant, there is apparent variation between office buildings (-3.82), high energy use buildings (10.00), and recreation buildings (19.47). This variation is explained by dramatic differences in building uses, which inherently relate to occupancy factors, set point temperatures, plug loads, and architectural designs such as glazing and other building penetrations that cause heat loss. In an attempt to estimate the impact of author affiliation, these variables are merely used as controls to help fit the model.

Another control is the number of LEED buildings in the original study, which is varied across studies. Studies range from having 1 to 254 LEED buildings. This variable turned out to be statistically significant. Studies with more observations are more likely to report higher energy savings. For every additional building in the model in the original studies, the model estimates -0.21 decrease in energy savings. This is intended to address the nature of the LEED studies, commonly coming from engineering and architecture disciplines where single buildings are analyzed in detail rather than the researcher examining many buildings and aiming for generalizability of research findings.

Limitations

Much of the backlash about reported energy savings from the LEED program has been directed at the study by the New Buildings Institute (Turner and Frankel, 2008) that was commissioned by the U.S. Green Building Council. I had expected to find additional LEED studies published by environmental organizations, but through the search method that I employed, only the NBI study has an environmental group as the primary author with 22 statistical models in that study. One other study – Diamond, Opitz, Hicks, Neida, and Herrera (2006) - has environmental representation but the primary author is from a government agency. Two options to circumvent the low sample of environmental authors are possible: 1) I could change the way that I construct the dependent variable so that the environmental authors on the Diamond et al. (2006) study are represented in the model, or 2) I could alter the literature search strategy, such as search the USGBC website for case study research. However, in reviewing blogs and articles capturing the debate about LEED energy savings, the NBI study is commonly referenced so it is possible that the meta-regression model is robust enough with just that study as the environmental primary author to adequately represent this particular scenario. Subsequent research could test the advocacy bias and interest group professionalism hypotheses in a different scenario to see if the results are comparable to findings from this study.

This research suffers from omitted variable bias in two ways. Ideally, a control variable would be included for the LEED program version/level, but this information was not conveyed in enough of the original studies to be included in the statistical models. Since LEEDs inception in 2000, there have been four versions of the rating system - v1 pilot version in 2000, v2 in 2005, v3 in 2009, v4 in 2013 - and four certification levels - Certified, Silver, Gold and Platinum. It is likely that energy consumption varies by LEED version due to changes in program requirements and LEED certification level due to the increased amount of points required for the higher certification levels.

Secondly, occupancy factors show the most unexplained effect on building energy use overall (Heidarinejad et al., 2014; Hsu, 2014; Kaddory Al-Zubaidy, 2015; Ryan and Sanquist, 2012). In a cluster analysis using energy simulations of LEED office buildings, Heidarinejad, Dahlhausen, Mahon, Pyke, and Srebric (2014) find that unregulated process loads, such as server equipment and plug loads, account for the majority of variation between office building clusters. Occupant factors have been historically difficult to model due to lack of data on the actual number of building occupants, how many hours they are in the building, their comfort levels in regards to indoor temperature, and their plug loads (computers, desk lamps, etc.) (Ryan and

Sanquist, 2012). These factors are cited as a critical missing link to predicting building performance (Hsu, 2014; Kaddory Al-Zubaidy, 2015).

Discussion and Conclusion

Game theory explains motivations for interest groups to present biased policy information, and scenarios under which this situation is expected to occur, such as in the presence of oppositional groups that may present incongruous information. This is an information asymmetry problem between policymakers and interest groups where interest groups might engage in strategic issue framing and produce empirical information that advances their policy positions. Advocacy bias supposes that information from interest groups is "hopelessly biased," as Ainsworth (2010) suggests. Alternatively, interest groups may approach empirical results more objectively regardless of what the findings suggest for their policy position because they seek to maintain a professional reputation and credibility is needed to gain trust from a policymaker. Information sharing occurs in a repeated games environment where interest groups have long-term relationships with policymakers.

This research examines these two competing views of interest groups, *advocacy bias* and *interest group professionalism*, in an often neglected type of policy domain – highly technical and low salience. In the case of LEED buildings, one report in particular became the subject of an advocacy bias debate, with concerns raised on building selection, statistical methods, and analysis of site energy rather than source energy (see quotations in Theory section). The 2008 New Buildings Institute study was a key piece of information, cited in much of the subsequent work that questioned whether LEED buildings save energy. In addition, program critique of no minimum energy requirements beyond the building codes has fueled much of the debate on uncertainty of energy savings from LEED buildings, a program specification that has recently been changed to require minimum above-code energy standards. I did not expect that the NBI study would be the only study found with an environmental organization as the primary author. This could be due to the academic database search rather than a more comprehensive web engine search. Even still, the 22 models in the NBI study provide evidence for advocacy bias with the at least 15 percent higher energy savings reported overall. I found that reports authored by individuals associated with an environmental organization systematically reports higher energy savings than academic authors or government agencies based on a total sample size of 164 statistical models. It is reasonable to think that patterns observed here, where the stakes may be lower and less conflict ridden, will be magnified in other areas.

Policy Implications

A consequence of advocacy bias is that it could undermine program designs and the reputation and credibility of program designers. Particularly this occurs when different interest groups present incongruous information to policymakers and stakeholders (Lopipero et al., 2007), which has been happening in the case of the LEED program. Policymakers and program participants have expectations about results that will be achieved by adopting or participating in a program. The expected results are commonly set forth by technical analyses of building energy consumption. While architecture and engineering studies on energy consumption are useful in understanding LEED program impacts, meta-regression methods account for systematic variation across studies, lending insights into how and why inconsistent information about the LEED program is being shared. Understanding systematic variation in technical analyses helps to inform discussions on program effectiveness and if programs should be continued, modified or expired. The recent modification to LEED which requires minimum energy requirements is expected to help assure policymakers that LEED buildings will save energy.

Tables and Figures

Table 5-1. Hypotheses

Model Typology	Direction	Core Concept
Advocacy Bias	Negative	Interest groups have strategic incentives to release or withhold information.
Interest Group Professionalism	No Effect	Interest groups need to maintain a positive reputation, trust and credibility.

Table 5-2. Articles Retrieved by Database

Database	**# Articles Retrieved**	**Phase 1 Inclusion**	**Phase 2 Inclusion**	**Final Sample**
EBSCO Host	361 articles	50 articles	18 articles	4 articles
Web of Science	232 articles	42 articles	8 articles	3 articles
Google Scholar	980 articles	155 articles	64 articles	15 articles
Total	1,573 articles	247 articles	90 articles	22 articles

Table 5-3. Studies Used in this Analysis

Author	**Number of Models in the Study**	**Number of LEED Buildings in the Study**	**Affiliation of Primary Author**
Turner and Frankel	22	121	Environmental
Menassa, Mangasarian et al	22	22	University
Oates and Sullivan	19	25	University
Diamond, Opitz, Hicks et al	18	18	Government
Scofield	16	31	University
Newsham, Mancini and Birt	16	98	Government
Fowler et al	16	16	Government
Chen, Lee and Wang	9	3	University
Scofield and Doane	6	84	University
Xu, Huang, Jin et al	2	2	Government
Stoppel and Leite	2	2	University
Sabapathy, Ragavan et al	2	4	University
Kern, Antoniolli, Wander et al	2	2	University
Issa, Attalla, Rankin, and Christian	2	3	University
Deru and Torcellini	2	2	Government
Agdas, Srinivasan, Frost et al	2	10	University
Thiel, Needy, Ries, Hupp et al	1	1	University
Michael, Zhang and Xia	1	1	University
Li, Hong and Yan	1	1	Government
Hong, Yang, Hill, and Feng	1	1	Government
Attia	1	1	University
Asensio and Delmas	1	254	University
N (Observations)	164	702	

Table 5-4. Variables and Descriptions

Variable	Description
Dependent Variable	
Percent change in energy use intensity	Measured by comparing the EUI of LEED buildings to non-LEED buildings. The data is reported in original studies.
Interest Groups (Focal Predictor)	
Primary author affiliation	Categorical variable for university, environmental NGO or government agency. Data is collected from journal articles' information about the corresponding author.
Study Characteristics (Control Variables)	
Type of energy unit	Dichotomous variable for site or source energy
Building use type	Categorical variable for high energy building use types (data centers, laboratories, hospitals), building types greatly affected by occupant behavior (office), and other building types.
Measurement method	Dichotomous variable for field observation or modeling simulation
Number of Buildings	Count of number of buildings in the statistical model

Table 5-5. Descriptive Statistics

Variable	Min.	Mean	Max.
Year	2005	2011	2018
Primary Author: University	0	0.52	1
Primary Author: Environmental Interest Group	0	0.13	1
Primary Author: Government Agency	0	0.34	1
Field Measurement	0	0.85	1
Modeling Simulations	0	0.15	1
Uses CBECS as Baseline	0	0.46	1
# of LEED Buildings	1	13.29	254
United States	0	0.90	1
Office Building	0	0.46	1
High Energy Building Use Types	0	0.29	1
Recreation Buildings	0	0.17	1

Table 5-6. Paired T-test of Site Energy Use Intensity for LEED and Baseline Buildings

Variable	Obs	Mean (kBTU/square foot)	Std. Err.
Site EUI for LEED Buildings	127	106.4	7.33
Site EUI for non-LEED Buildings	127	120.6	8.50
Difference	127	-14.16	1.18
t = 2.36 df = 125			

Figure 5-1. Box plot of Energy Use Intensity for LEED and Baseline Buildings (n=164)

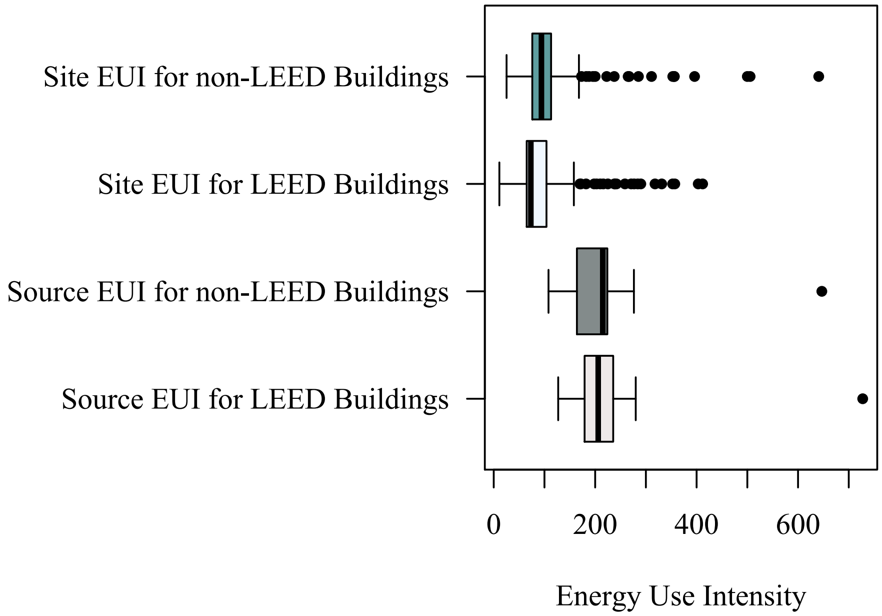


Figure 5-2. Box Plot of Energy Use Intensity by Building Type (n=164)

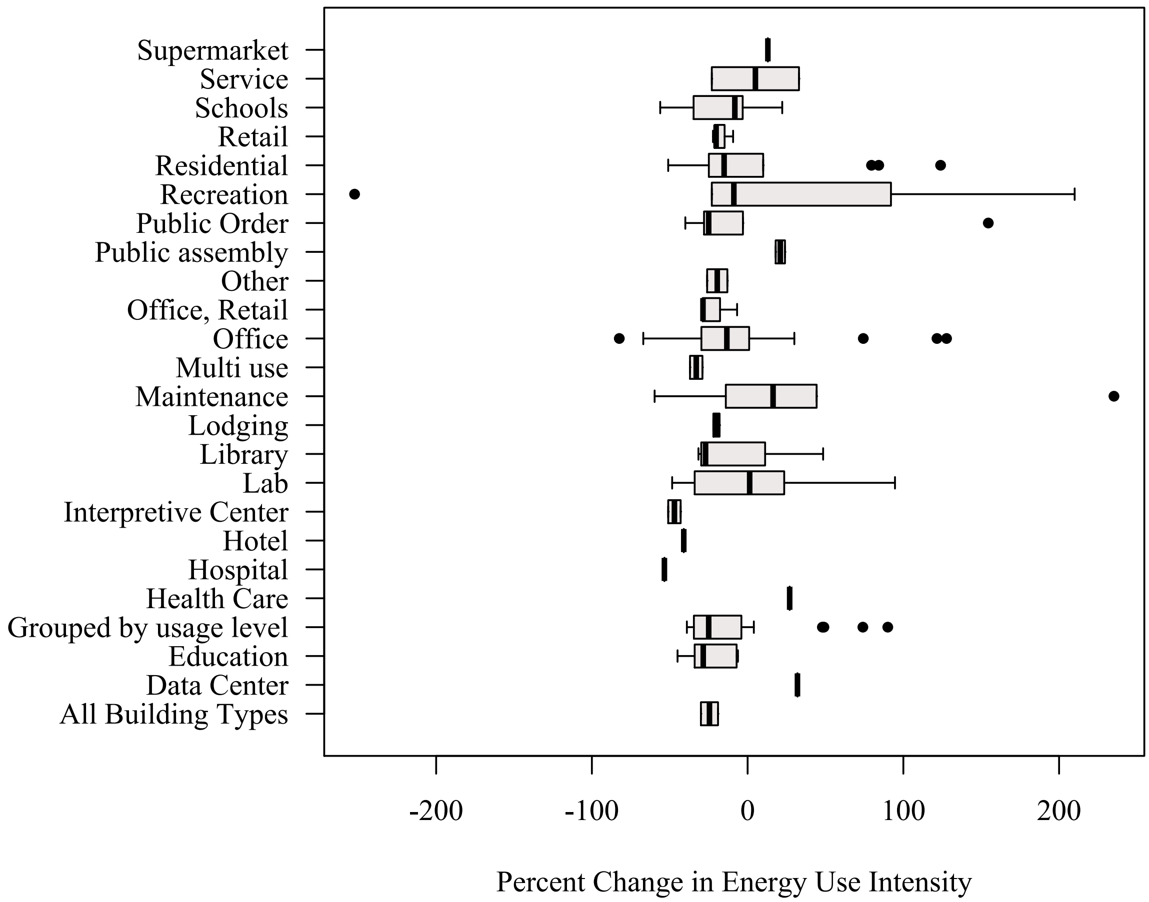


Figure 5-3. Scatterplot of Energy Use Intensity by Number of Buildings (n=164)

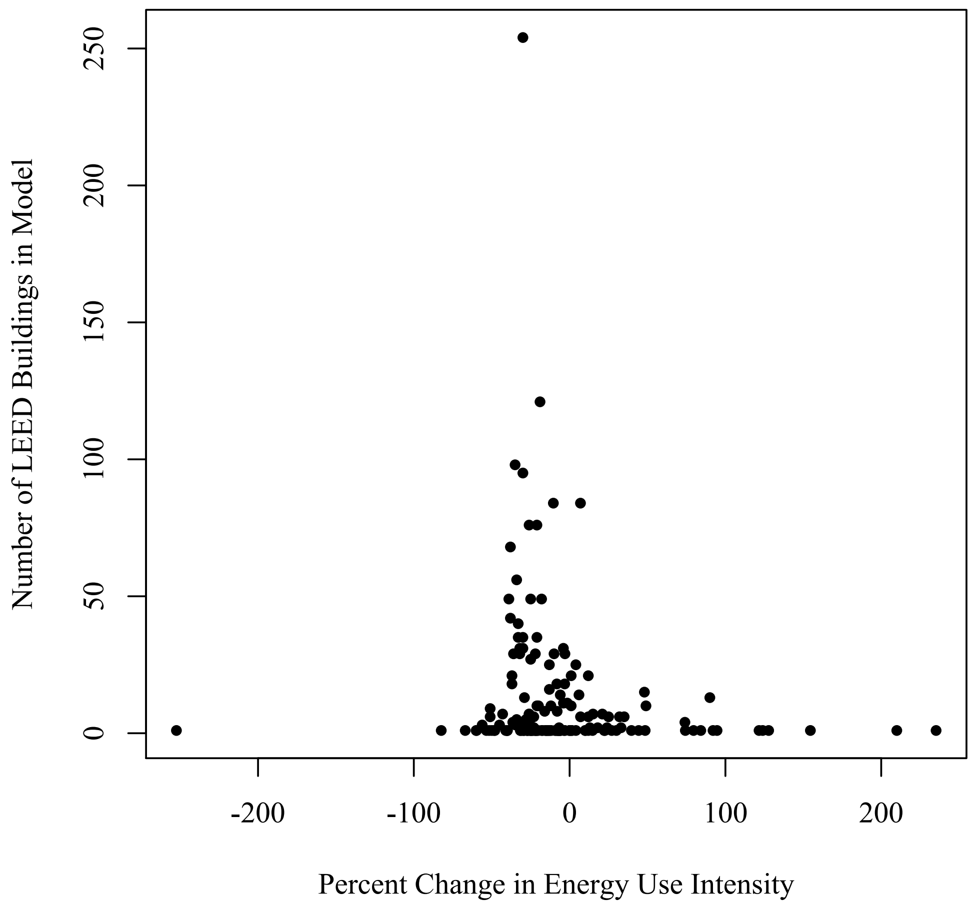
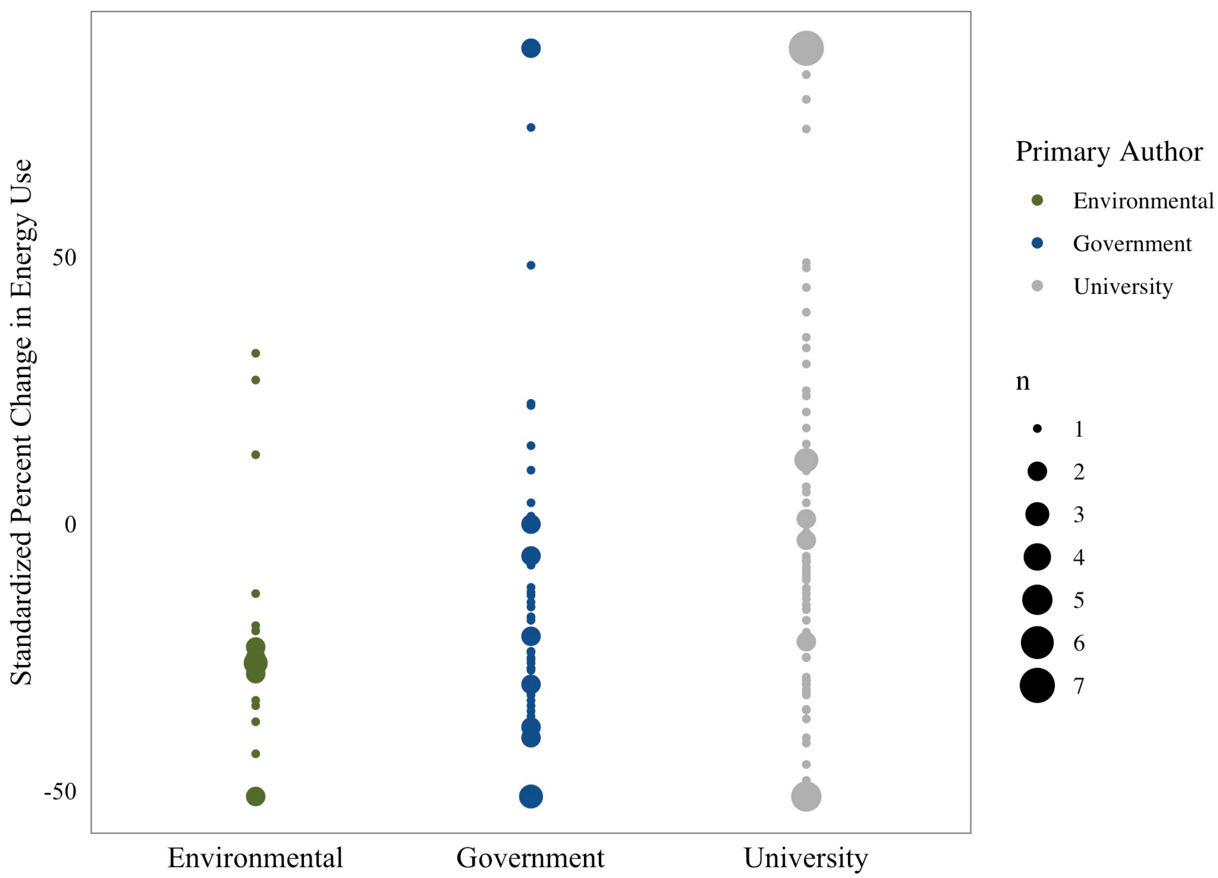


Table 5-7. Meta-regression Model

	Dependent variable: Percent Change in Energy Use	
Intercept	-29.09***	(11.07)
Primary Author: Environmental	-16.85*	(9.72)
Primary Author: University	14.49**	(6.41)
Field Measurement	-10.54	(10.00)
Compares to CBECS	4.80	(6.17)
Office Buildings	-3.82	(6.14)
High Energy Use Buildings	10.00	(10.84)
Recreation Buildings	19.47	(15.60)
United States	28.43**	(11.56)
Number of LEED Buildings	-0.21**	(0.10)
Observations	164	
Log Likelihood	-804.91	
Akaike Inf. Crit.	1631.81	
R^2	10.92%	
Note: Standard errors in parentheses	$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$	

Figure 5-4. Reported Energy Use by Primary Author Affiliation



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Appendix

Table 1. Codebook

Category	Variable Name	Decision Rules
Publication Details	Authors	List of authors
	Journal_type	Peer-reviewed Academic (0/1)
	Year of Publication	Year
Author Affiliation	Academic	any author from university (0/1)
	Environmental_NGO	any author from environmental NGO (0/1)
	Industry	any author from industry (e.g., consulting) (0/1)
	Government_Agency	any author from govt agency, inc. nat'l labs (0/1)
Study Design	#_LEED_Buildings	# of LEED buildings in the model
	Field_Measurement	Model evaluated energy use w/ energy bills (0/1)
	Modeling_Simulations	Model used simulation w/o energy bills (0/1)
	Compare_CBECS	Model compared subject building to CBECS (0/1)
Program Detail	LEED program level	Category for silver, gold, platinum
	Number of Energy Credits	# of LEED credits in the energy category
Energy Evaluation	Site_Energy	Model evaluated site energy (0/1)
	Source_Energy	Model evaluated source energy (0/1)
	EUI=0, Not EUI = 1	Model evaluated EUI; 0 = Model evaluated other energy unit (e.g., electricity, gas) (0/1)
	EUI_Site_Subject	Reported site EUI of the subject building (0/1)
	EUI_Source_Subject	Reported source EUI of the subject building (0/1)
	EUI_Site_Baseline	Reported site EUI of the baseline building(s) (0/1)
	EUI_Source_baseline	Reported source EUI of the baseline building(s) (0/1)
	% Savings	(Baseline EUI - Subject EUI) / Baseline EUI
	% Change Energy Use	% Savings * (-1)
Location	United_States	Subject building is located in US (0/1)
Building Use Type	Office	Building is office use type (0/1)
	DataCenters_Labs_ HealthCare	Building is data center, lab or health care use type (0/1)
	Other_Building_Use_Types	Building is not office, data center, lab, health use type (0/1)
Control	Occupancy	Model accounts for occupancy (0/1)

Table 5-8. 22 Studies Included in Meta-Regression Models

Agdas, D., Srinivasan, R. S., Frost, K. and Masters, F. J. (2015). Energy use assessment of educational buildings: Toward a campus-wide sustainable energy policy. *Sustainable Cities and Society*, *17*, 15-21.

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Chapter 6 Conclusion and Lessons Learned

My intent with this dissertation research is to discern if business interest group involvement in urban sustainability policymaking increases or decreases the likelihood of policy adoption. Extent research finds inconsistent effects that business interest groups have on urban sustainability policy; both positive and negative effects are found with varying magnitude. Attempting to understand why effects are so varied, the overarching research question for the dissertation is *Under what conditions do business interest groups increase or decrease the likelihood of policy adoption?*

Urban sustainability research generally covers many activities within a community, such as transportation, buildings, waste, water and more. In order to understand business interest group dynamics, I deeply explore one issue area – the buildings sector. My reasoning is that the sustainability field to too broad to generalize the effects of interest groups across the various sub-sectors of urban sustainability as each sub-sector has distinctive interest groups with different motivations, policy preferences, power, influence, access to policymakers and resources.

The first contribution that this dissertation makes to the urban sustainability field is sector-specific research to reveal nuances of interest group dynamics within a single issue domain using common urban sustainability theories and methods that explain what influences policy adoption. While sector-specific research is widely available, it rarely makes an explicit tie to urban sustainability theory.

The second contribution is how I am operationalizing business interest groups. I segment the construction industry into what I call ‘traditional’ and ‘green’ categories in an attempt to distinguish divergent policy preferences within the construction industry and how they differently effect policy adoption. The only other article that I found that does this is Jenner et al

(2012) in the Energy Journal examining the effects of renewable and nuclear energy industry associations on the adoption of Renewable Portfolio Standards. Most extent research treats business interest groups as one homogeneous category, but that does not seem accurate because within a single industrial group there is so much variation in motivations, policy preferences, and market segments. For example, some homebuilders are traditional and conservative and generally oppose building regulations while others are innovative and supportive of green building. I wanted to see if I could segment the construction industry into these distinctive categories to explain conditions under which types of business interest groups support or oppose building regulations. Portney and Berry (2016) had a similar goal, but their approach was to administer surveys to 50 cities to identify various types of interests that participate: HOAs, developers, environmental groups, chambers, etc. While their goal was similar, their approach was different from my approach to look within a single interest group category. I find that distinctive segments of business interest groups for the construction industry have distinguishable effects on policy adoption. Traditional industry associations tend to limit the probability of sustainability policy adoption for the buildings sector while 'green' industry associations tend to increase the likelihood of adoption. Interest group segmentation of an industrial category can help to explain the nuanced effects that sub-groups have on policy adoption.

Another contribution is considering policy scope and the target population. May and Koski (2007) explain that the typical behavior of firms to oppose environmental regulation does not necessarily apply to green building policies because they are most often aimed at public buildings. I built on that proposition by testing two different case selections – building codes aimed at private buildings and green building programs that have historically been aimed at public buildings – to see how the effects differ depending on the policy scope and the target population. I find that the effects of interest groups are mediated by the type of policy that is considered. The type of policy (e.g., applies to public or privately-owned buildings) determines the impacts of cost burdens to the construction industry and the level of involvement of the builder segment in the specific market affected by the policy.

Throughout the research I emphasize that this is a low salience policy issue. Interest group theories are generally developed while studying high salience issue areas, so I emphasize how interest group theories apply in a low salience issue area that attracts technical experts more so that citizen groups, which I think is relevant to many of the technical aspects of sustainability.

The final contribution is methodological. City-level data collection is notoriously difficult, which is probably why researchers have used proxies to measure interest group activity rather than more directly measuring interest group presence. In this research, I use Python for web scraping to construct the variable for interest group presence as counts of interest group members per city. This is an alternative method rather than using a national data source or surveys to construct the interest group variable which is the more common approach in policy studies. I find that the algorithmic data collection process is most robust and manageable where member information is centralized in a common directory, such as the case with the Building Owners and Managers Association (BOMA). Contrastingly, where member lists are decentralized on regional association chapter websites, such as the National Association of Home Builders (NAHB), a generalized algorithm is required, yet difficult to execute given the variability in website design and programming syntax (e.g., HTML tags). Even still, an algorithmic data collection process is relatively comprehensive, efficient and replicable compared to many other data collection process, such as survey administration.

Regarding lessons learned, perhaps the single traditional industry association, BOMA, represented in Chapter 4 does not have as much of an effect than was thought despite BOMA's explicit oppositional policy statement (see p. 70), and other industry groups may have more effect. This is a limitation of the dissertation; it only examines three organizations involved in the buildings policy domain, but many more organizations are actually involved. For example, an article by Emily Badger (2013), "Why are some states trying to ban LEED green building standards?", points to the American High-Performance Buildings Coalition as an industry-led coalition of 42 organizations that formally oppose LEED on some grounds. The Coalition supports "reasonable performance based policies" and "voluntary adoption" similar to BOMA's green building policy position statement. A subsequent study could model the sums of members in the 42 industry groups in addition to BOMA members for an estimation of their effects on mandatory green building policy adoption at the local level. However, data collection could be resource intensive. While algorithmic data collection provides efficiencies, the ability to algorithmically collect data depends on the structure of web data and design and security of the website. The availability of an Application Programming Interface (API), such as the API for Census data, makes algorithmic data collection easy, secure, reliable and replicable, but a lot of good data does not yet have an API.

In Chapter 5, the central pillar of the advocacy bias theory is that interest groups construct information that supports their policy position or negates oppositional positions. Framing interest group professionalism which involves trust and credibility with policymakers as a duality with advocacy bias may have been wrongly assumed because, similar to interest groups, policymakers also have policy positions that they support and therefore may equally seek information that supports their positions and negates oppositional positional positions. It may actually be beneficial to policymakers to align with interest groups who strategically over- or under-estimate program impacts in their favor. This insight affects the theoretical foundation of Chapter 5, but not the statistical model. Considering policymakers' preferences has a more central role in game theory modeling than the meta-regression approach pursued here.

In summary, my research is situated within urban sustainability literature. It contributes to understanding interest group dynamics at the city-level in a low salience policy domain attracting technical experts with minimal public attention or citizen involvement. I use a novel approach to examining the effects of interest groups by segmenting a single industrial category to better understand how divergent policy preferences differently effect policy adoption. For a methodological contribution, I use Python for algorithmic data collection to overcome the difficulties associated with quantitative research at the city-level.