Introduction

Many emerging policy challenges in the 21st Century are not clearly definable and feature many complex interrelationships that severely complicate efforts to clearly articulate the problem, effectively assess its causes and consequences, or even predict how proposed solutions will contribute to addressing the problem (Zellner & Campbell, 2015). Pressing public policy issues such as "terrorism" or "sustainability" are tightly entangled within many other related policy issues, so addressing them requires successfully negotiating complex interactions between existing governing activities (Zellner & Campbell, 2015). While the perceived impending future threat of climate change has stirred a great deal of interest and debate at the global scale, its complex nature (Lazarus, 2010; Levin et al., 2012), has helped stymie the sustained effort to develop a comprehensive international response (E. Ostrom, 2010).

Those interested in successfully combating climate change emphasize the importance of "mainstreaming" considerations about climate change mitigation or adaptation into ongoing efforts to address other policy goals and everyday public policy decisions (Denton et al., 2014; Measham et al., 2011). Case studies have identified that the ability to effectively align addressing concerns about climate change with achieving other prevailing public policy goals is an important step towards the development of climate change mitigation and adaptation policies in cities (Aggarwal, 2013; Anguelovski & Carmin, 2011; Carmin, Anguelovski, & Roberts, 2012; Heinrichs, Krellenberg, & Fragkias, 2013). In many cases, climate change mitigation and adaptation efforts develop in an ad hoc manner as cities attach considerations about mitigation and adaptation to their existing goals, plans, and programs (Anguelovski & Carmin, 2011; Carmin, Anguelovski, & Roberts, 2012; Krause, 2013).

Policy issues like these not only challenge policy makers, but policy process scholars as well because complex problems are not cleanly addressed by the silos of policy making activity that have solidified around established policy domains (Burstein, 1991) or subsystems (Baumgartner & Jones, 1991; Sabatier & Jenkins Smith, 1993) that have been the major focus of those studying the policy process for many years (Jochim & May, 2010). More research is needed to develop our understanding about the forces that underlie the development of policies that address issues spanning across policy actions and subsystems (Jochim & May, 2010).

Based on an empirical analysis based on survey responses from 287 cities, my goal in this paper is to advance our understanding of the conditions that underlie the initial adoption of climate change mitigation and adaptation considerations and the extension of their influence across multiple areas of policymaking efforts in cities. In particular, I empirically examine and compare the role of factors related to social change, crisis, and establishing nascent coalitions; as well as those associated with the city's political economy or conditions that might allow a developing community of interest to grow. I use a hurdle model on the same set of independent variables that simultaneously reports results related to a binary model assessing the adoption of these issues as ones influencing city policymaking actions as well as a Poisson count model addressing the number of policymaking areas assessed that their influence extends across. Those studying climate change policy have debated the potential synergies or conflicts that might emerge regarding the adoption and development of policy actions related to climate change mitigation and climate change adaptation (Landauer, Juhola, and Söderholm, 2015; Watkiss, Benzie, and R. Klein, 2015). However, studies that provide comparative empirical examination of how conditions in governing contexts currently shape the pursuit of mitigation and adaptation are still rare.

In the next section, I offer a literature review providing more detail concerning climate change mitigation and adaptation policy in cities as complex problems that cut across various areas of city policymaking efforts. I then detail the development of my analysis including a description of my dependent variables and the survey that they came from, my model selection, and the independent variables and hypotheses. The fourth section provides a summary of results which is followed by Discussion and Conclusion sections that summarize and explore the implications of the results.

Climate Change Mitigation, Adaptation, and City Policy Considerations

A number of quantitative studies have focused specifically on the question of why cities decide to take on climate change policies (Krause, 2011; Krause, 2012b; Sharp, Daley, & Lynch, 2011; Zahran et al., 2008; Wood, Hultquist, & Romsdahl, 2014; Bae & Feiock 2012), but likely due to the more defined and developed nature of cities' attention to climate change mitigation (Bulkeley, 2010; Sugar, Kennedy, & Hoornweg, 2013), these studies have focused on this issue rather than adaptation (but see Wood, Hultquist, & Romsdahl, 2014). To understand the initial adoption of climate change policies, some of these studies have examined factors associated with a binary outcome: whether a city has committed to a range of climate change actions across multiple policymaking areas through membership in climate-protection networks (Zahran et al., 2008; Krause, 2011; Sharp, Daley, & Lynch, 2011; Krause, Yi, & Feiock, 2016). Some have looked in more detail at non-binary outcomes: the extent to which a city has actually implemented particular policies or policy tools (Sharp, Daley, & Lynch, 2011; Krause 2012a; Krause 2012b; Bae & Feiock, 2012; Wood, Hultquist, & Romsdahl, 2014; Yi, Krause, & Feiock, 2017). However, this research has provided some indication that participation in climate-

protection networks might not be a particularly straightforward indicator of the adoption of climate change-related efforts (Krause, 2012a; Yi, Krause, and Feiock, 2017). Therefore, there is a need for analysis that can more directly compare factors associated with a city's adoption of policy considerations related to climate change mitigation and adaptation with factors associated with these considerations' extension across policymaking activities.

Understanding the extension of these considerations across policymaking activities is critical because climate change mitigation and climate change adaptation are both amorphous and multifaceted challenges that stretch across policy sectors to affect many different aspects of life and public policy (Massey & Huitema, 2016; E. Ostrom, 2010; Prins & Rayner, 2007). Addressing climate change mitigation or adaptation is a long-term policy undertaking that will need to be tailored to suit local conditions and flexibly evolve over time to effectively address unpredictable changes. Cities consider climate change in their policy deliberations if they perceive that addressing this issue helps them fulfill internal goals or reduce perceived threats (Bassett & Shandas, 2010; Anguelovski & Carmin, 2011). A number of case studies have described that the ability to effectively align addressing concerns about climate change with achieving other prevailing policy goals is an important step towards the development of climate change mitigation and adaptation policies in cities (Aggarwal, 2013; Anguelovski & Carmin, 2011; Carmin, Anguelovski, & Roberts, 2012; Heinrichs, Krellenberg, & Fragkias, 2013).

Many scholars have theorized that an underlying "fiscal imperative" (Wolman & Spitzley, 1996) ultimately shapes city policymaking decisions. From this perspective, cities attempt to provide attractive mixes of public services and low taxation by focusing their attention on strengthening the city's financial standing and economic position (Peterson, 1981; V. Ostrom, Tiebout, & Warren, 1962). Economic development offers a relatively uncontroversial means of

ensuring quality of life improvements, because development generates additional revenue and investment for the city (Peterson, 1981; Stein, 1990). Research has shown that cities in the US perceive themselves to be in competition with other cities for development opportunities (Schneider, 1989, 29), city policymakers assess policies based on their budget impact (Schneider, 1989), cities almost exclusively focus on policies that will break even or potentially enhance revenue (Gordon, 2007), and competition between local governments can enhance public service efficiency (Foster, 1997). Globalization has intensified intercity competition for investment and resources for cities both inside and outside the US (Douglass, 2002; Savitch & Kantor, 2003).

However, cities do not make these choices in a vacuum. Cities operate within a broader "local public economy" (Oakerson & Parks, 1988) of overlapping jurisdictions related to the provision and production of particular services or "public sector industries" by public and private entities (V. Ostrom & E. Ostrom, 1991). For example, within a particular metropolitan region, many cities might decide to share water resources, oftentimes with a number of smaller cities simply purchasing water from a larger central city. Therefore, cities act as "unitary actors seeking to maximize economic and status interests" (Feiock, 2002), but make these decisions as participants in dynamic systems that feature collective action opportunities shaped by the actions of other cities (Feiock, 2007).

In theory, cities seek to find the best balance between economies-of-scale (the efficiency benefits associated with scaling up service production) and minimization of spillover effects (the costs and/or benefits associated with a service extending beyond the jurisdiction managing them) (E. Ostrom, 1972). Cities with many neighbors frequently face collective action problems (E. Ostrom, 1990; Feiock, 2013) in which they individually bear the costs of their policy efforts while other cities might enjoy the collective benefits of their efforts. Competition between cities

clustered within larger and more fragmented metropolitan areas can produce greater collective action challenges as smaller cities might be able to "free ride" off of the actions of larger cities (Feiock, 2013; Hendrick & Shi, 2015).

Surveying Policy Actions and Issues

My goal in this paper is to advance our understanding of climate change mitigation and adaptation's adoption as issues that influence city policy efforts as well as the extension of their influence across multiple areas of city policymaking. To address these questions, during the spring and summer of 2015, I distributed a survey to staff members in 822 mid-sized cities throughout the eight Great Lakes states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin). These states are commonly associated with the US' "Rust Belt" – an area of the country whose economy was heavily reliant on manufacturing that has experienced widespread declines in population as well as economic conditions in the last half century (High, 2003; Longworth, 2009). This region's history of economic setbacks and pressure to discover innovative policy strategies to stimulate urban revitalization (High, 2003) make it a particularly fertile area for analyzing how factors associated with a city's prevailing political economy are related to the decision to embrace new policy issues. I also chose to analyze mid-sized cities in order to observe the conditions that drive actions in cities that are not commonly seen as leading players in the development of policy innovation. Therefore, my population included all of the cities in these states with a population between 5,000 and 500,000 for which I could find a viable email contact.[1] City council clerks were my primary targets for this survey.

[1] This total also did not include eight cities which are pursuing extensive work around climate change mitigation and adaptation because I did not want my previous working relationship with them on these issues to bias the results.

As part of their responsibilities, council clerks objectively document the city governments' activities and legislative efforts. Therefore, clerks should be relatively unbiased observers of the cities' policy deliberations (Schneider, Teske, & Mintrom, 1995). To this end, city council clerks were the final contact for 725 cities. However, whenever clerks were not available, I contacted other available administrators: City Administrators (51 cities), other staff in the administration such as Finance Directors or planners (38 cities), or City Managers (8 cities).

[Insert Table 1 "Fifteen Policy Actions and Their Policymaking Areas Used in Dependent Variables" about here]

My survey included a list of fifteen policy actions (Table 1) that the city could potentially be undertaking that could be tied to climate change mitigation and/or adaptation. I compiled this list by adapting existing lists developed for major global cities such as UN-HABITAT's (UN-HABITAT, 2011)[2] to include actions that would be most relevant for the cities in my survey population based on my years of experience working on climate change planning with mid-sized cities in the region with the Great Lakes Adaptation Assessment for Cities (GLAA-C) and Great Lakes Integrated Sciences & Assessments (GLISA). My experiences with cities during this time reflected that they each viewed their interpretation of climate change mitigation and adaptation efforts through the lens of their own local public economy, politics, and financial and economic development conditions.

Therefore, I designed the survey to allow respondents to report whether their city's considerations regarding climate change mitigation or adaptation were influencing particular

[2] UN-HABITAT's discussion of adaptation includes topics that might be considered exclusive to mitigation in other contexts, as securing energy and water is considered a form of adaptation (UN-HABITAT, 2011; Broto and Bulkeley, 2013). I have similarly allowed my respondents to report that their considerations about adaptation influence policy actions addressing energy.

policy activities. I asked respondents to report whether or not the government of the city had "taken or been involved" in these fifteen policy actions in the last five years. If they responded that the city had taken a particular policy action, they could then select whether or not the city's considerations about climate change mitigation, and/or the city's considerations about climate change adaptation had influenced this policy effort or not based on the respondents' observations of the city's policy deliberations. To provide some consistent framing for these respondents' reflections on these issues' place in city policy deliberations, the question included a definition of climate change mitigation for them to use – "an effort to reduce emissions associated with climate change" – as well as a definition of climate change adaptation for them to use – "an effort to prepare for potential impacts associated with climate change."

[Insert Table 2 "Population and Survey Comparison for Selected Characteristics" about here]

I received a total of 287 complete responses (response rate: 35%). Table 2 provides a comparison between the sample and the population based on a few basic characteristics. Z-tests comparing the sample and population means found no statistically significant differences between the two for the characteristics measured.

These policy actions fit under seven areas of policymaking that these cities might pursue: built environment, land use, natural environment, transportation, energy use, water management, and emergency management (see Table 1). To examine the spread of the influence of climate change mitigation or adaptation across these seven areas of policymaking, I consolidated these responses regarding particular policy actions based on their related area of policymaking. For example, if a city said that climate change mitigation had influenced their efforts related to increasing their tree canopy, but not their efforts related to enhancing parks; I would still mark that the city's efforts related to the natural environment had been influenced by considerations

about climate change mitigation. Through this process, I developed two outcome variables (one for mitigation and one for adaptation) related to the number of areas of policymaking that these issues had influenced in each city. Table 3 provides a summary of the percentage of responding cities (out of the 287) that reported that their policy actions were influenced by climate change mitigation or adaptation for each of the seven areas of policymaking.

[Insert Table 3 "Percentage of Cities whose Policy Actions were Influenced by Mitigation or Adaptation by Policy Area" about here]

Analyzing Policy Adoption and Extension

Hurdle Model Selection

My dependent variables in this analysis are the number of policymaking areas analyzed that a city is undertaking that were influenced by climate change mitigation or climate change adaptation. With a range of only the integers from 0-7, both dependent variables were count variables. The distribution of these dependent variables also featured a large number of zeros as 61% of the cities surveyed did not say any of their areas of policymaking were influenced by climate change mitigation and 62% said that none of them were influenced by climate change adaptation. These dependent variable characteristics led me to choose to perform my analysis using a hurdle model. Hurdle models produce two sets of results. The first is the results of a binary probability model that predicts whether the issue being analyzed has influenced policy action in the city (1) or not (0). This first result is therefore characterized as addressing whether a hurdle (or threshold) of action is crossed. The second result of the hurdle model is a count model truncated at zero that assesses the factors underlying how many of the seven areas of policymaking activity assessed were being influenced by that issue once the city had already crossed the initial hurdle. As an example of this sort of sequential process, a person might first

decide they will certainly buy something (the first model) and then they decide how much they will buy (the second model). The hurdle models used here therefore offered the opportunity to simultaneously assess the factors that are associated with a city adopting climate change mitigation or adaptation as an issue that influenced at least one area of policymaking in the city or not, as well as the factors associated with the number of the policymaking areas in the city assessed to which these considerations about mitigation or adaptation extended. I completed all the analysis in this paper using R Statistical Software.

Independent Variable Selection

[Insert Table 4 "Summary of Independent Variables" about here]

Those studying policy efforts that cross existing boundaries of policy activity have discussed how different forces might affect the emergence of policy issues versus their expansion into different areas of policymaking (Jochim & May, 2010). They connect the emergence of such issues with factors associated with research on policy change generally: social changes and crises that represent opportunities for new strategies (Kingdon, 1984; Schneider, Teske, & Mintrom, 1995) as well as those that might facilitate the development of supportive coalitions (Cashore & Howlett, 2007; Jones & Jenkins-Smith, 2009).

For this reason, I included nine independent variables in my hurdle model regressions that reflect factors that might be associated with these conditions, and therefore, a city's adoption (or not) of climate change mitigation or adaptation as an issue influencing at least one area of city policymaking efforts (Table 4 provides a full summary of all of the independent variables). The first is the presence of an economic development policy entrepreneur who is actively advocating for the city to change its approach to economic development. This variable was developed through a series of surveys described in a previous study (Kalafatis & Lemos, 2017).

Such development entrepreneurs both themselves emerge in response to social change and crisis (Schneider, Teske, & Mintrom, 1995), and might also disrupt the city's prevailing development strategy in ways that create space for other new policy issues to take root (P. Klein et al., 2010). The second was the presence of a climate change policy entrepreneur. Many studies on the development of climate change mitigation and adaptation policies in cities have identified that such individuals help drive action on these issues in their cities through recruiting others to support their efforts (Bulkeley & Kern, 2006; Burch, 2010; Collier & Löfstedt, 1997; Kalafatis, Grace, & Gibbons, 2015; Lambright, Chagnon, & Harvey, 1996; Mukheibir & Ziervogel, 2007; Roberts, 2008; Wejs, 2014). I also included a measure of the number of natural disasters that a city experienced from 2000-2014. Weather-related natural disasters are potential "focusing events" (Kingdon, 1984) that might encourage cities to consider pursuing climate change mitigation and adaptation related policies (Measham et al., 2011). I next included three potential institutional sources for the idea of climate change mitigation or adaptation policy actions to originate and potentially be cultivated through a nascent coalition. The first is a binary variable describing whether or not the city possesses an environment (or sustainability) focused department or commission. The second is the number of wards in the city that directly elect city council members – more districts within the city might make it more likely that a like-minded coalition of individuals can pursue a relatively progressive policy undertaking like climate change mitigation or adaptation (Kalafatis & Lemos, 2017). The third is a city's membership in a multi-city coalition related to sustainability. City participation in such a network not only represents a level of institutional commitment to environmental concerns, but also potential external sources promoting climate change mitigation or adaptation related action that those in the city have endorsed (Krause, 2012a).

Finally, I included three measures of the coalition formation environment. The first is the partisanship of the city (Lean Democrat) – the share of the vote Barack Obama (D) received compared to Mitt Romney (R) in precincts within the city in the 2012 presidential election. In the US, identifying as a Democrat/liberal or Republican/conservative is a predictor of perceptions about climate change (Marquart-Pyatt et al., 2014; McCright & Dunlap, 2011), so in theory a partisan lean towards the Democratic Party in a US city would make forming a coalition around climate change mitigation or adaptation more likely there. A heavy economic dependence on the manufacturing sector represents a significant economic coalition in the city that might suppress climate change mitigation or adaptation (Krause, 2011). Therefore, I included a measure of the value added to the city economy of the manufacturing sector by dividing the value added to the city economy by NAICS codes associated with manufacturing by its total GDP. When these values were not available, I used the county values as a substitute. Finally, I included a binary variable describing whether the city had a council-manager form of government (1) or not (0) as these forms of government are considered more likely to pragmatically pursue climate work because they are relatively insulted from potential political impacts (Bae & Feiock, 2012).

Crosscutting interests can engender political support that ties individual policy subsystems together into a wider community of interest (Jochim & May, 2010). Therefore, my variables that address the extension of the influence of climate change mitigation and adaptation across areas of policymaking focus on measures of the city's prevailing political economy as well as other conditions that might allow a developing community of interest to become larger. The first two relate to existing financial conditions. The first is a ratio measure of the city's revenue versus expenditures from its available budgets from 2006-2010 in order to understand

the implications of available budget surpluses or shortfalls.[3] The second is the percentage of city revenue that came from intergovernmental funds based on their available budgets from 2006-2010. Dependence on higher levels of government for funding might shape how extensively a city decides to pursue an issue that these higher levels of government might have an interest in either supporting or restricting.

The next three independent variables were related to the city's prevailing socioeconomic conditions and resources. First, I included a measure of the level of social deprivation in the city using the city's unemployment rate. Next, I included median household income. Third, I included a measure of the college education attainment rate in the city which has emerged as a human resource in the population of the city that supports the development of climate change policy in other studies (Krause, 2011; Zahran et al., 2008).

Finally, I included two variables that could help describe the city's footprint in its region. The first is the number of other municipalities in a city's metropolitan or micropolitan region or county. The presence of other municipalities in these regions can affect how cities approach their considerations about policy decisions (Schneider, 1989; Stein, 1990), including reducing the extent to which they implement climate change mitigation (Sharp, Daley, and Lynch, 2011), possibly due to deepening collective action challenges associated with reducing emissions. Finally, I included the population of the city as an independent variable based on the idea that larger cities would simply have more policy activity taking place and perhaps experience more

[3] I choose this period because it largely preceded the period of time of policy action that I asked respondents about (mid-2010 – mid-2015). That way it would be less likely that it was these policy actions themselves that had led to the existing budget conditions. I made similar considerations regarding the other socioeconomic conditions drawn from 2005-2009 American Community Survey estimates (see Table 4).

pressure to pursue activities to address climate change than smaller ones based on their larger regional footprint.

Results

[Insert Table 5 "Results Estimating Binary Models and Poisson Count Models" about here]

Binary Models Results

Table 5 provides a summary of the regression results. Regarding my binary logistic regression results from the models, four of the independent variables that I hypothesized would be associated with the adoption of climate change mitigation as an issue influencing an area of city policymaking did have a statistically significant association with that outcome. In terms of predicted probabilities, the overall likelihood of a city in my model adopting climate change mitigation as an issue influencing at least one area of policymaking was 0.48. Two of the "sources of disruption" adoption variables – the presence of an economic development policy entrepreneur and having experienced a greater number of natural disasters – were associated with at least one area of city policymaking being influenced by policy mitigation at the $p < 0.01$ level. If a development entrepreneur was not present, the likelihood dropped to 0.27 while if one was present it rose to 0.55. If a city had only experienced three disasters (10^{th} percentile in my dataset) their likelihood was 0.35, but if they had experienced nine disasters (90^{th} percentile) it rose to 0.58. Two of the "institutional sources" adoption variables were associated with adoption at the $p < 0.05$ level: having an environmental or sustainability department or commission and the number of wards in the city directly electing city council members. If a city did not have an environment or sustainability department or commission, its likelihood of adoption was 0.44, but if it did, the likelihood was 0.57. For wards, if a city had zero districts that directly elected

councilmembers (10th percentile) the likelihood of adoption was 0.37, but if it had seven districts (90th percentile) its likelihood would rise to 0.58.

Five of the variables that I hypothesized would be associated with the adoption of climate change adaptation as an issue that influenced city policymaking showed a statistically significant relationship with that outcome. The overall likelihood that a city in my dataset would adopt climate change adaptation as an issue that influenced at least one area of policymaking was again 0.48. For the "sources of disruption" adoption variables, the presence of a development policy entrepreneur was associated with the adoption of adaptation at the $p < 0.01$ level and the number of natural disasters was associated with adoption at the $p < 0.05$ level. If a development policy entrepreneur was not present, the likelihood that the city would adopt adaptation dropped to 0.24 and it rose to 0.57 if they were present. For the number of disasters, if a city experienced three disasters (10th percentile) the likelihood was 0.38 and the likelihood was 0.55 if a city experienced nine disasters (90th percentile). Regarding the "institutional sources" adoption variables, having an environmental or sustainability department or commission and membership in a multi-city coalition related to sustainability were associated with adaptation adoption at the $p < 0.01$ and $p < 0.05$ level respectively. If a city didn't have an environmental or sustainability department or commission the likelihood was 0.42, but if one was present the likelihood was 0.64. If a city didn't have such memberships in a multi-city coalition related to sustainability, the likelihood was 0.45 and 0.79 if they did. The city's economic dependence on manufacturing was negatively associated with adoption at the $p < 0.01$ level. If a city had a 0% manufacturing dependence (10th percentile of the dataset), the likelihood was 0.54 while it was 0.31 if a city had a 5% dependence on manufacturing (90th percentile). Two other variables that I had hypothesized would be associated with the extension of these issues across areas of

policymaking in the city also had a statistically significant association in the binary model: the city's level of dependence on intergovernmental funds ($p < 0.05$ level) and the percentage of its population that had attained a bachelor's degree ($p < 0.10$ level). If a city depended on intergovernmental revenue for 7.88% of its revenue (10th percentile) the likelihood was 0.37 and if their intergovernmental funds dependence was 30.24% (90th percentile) it was 0.58. Finally, if the city's bachelor's attainment rate was 12.46% (10th percentile) the likelihood was 0.39 while it was 0.58 if the attainment rate was 49.20% (90th percentile).

Poisson Count Models Results

The hurdle model also produced results that assessed my independent variables' association with the influence of climate change mitigation and adaptation extending across policymaking areas. My two variables related to city financial considerations – the city's budget surplus versus shortfall and dependence on intergovernmental funds – both had a statistically significant negative association with the number of areas of policymaking influenced by climate change mitigation (both $p < 0.10$ level). For the Poisson count mitigation model, the overall predicted value was 4.00. If a city had a budget surplus/shortfall ratio of 0.96 (10th percentile of the truncated Poisson dataset), the predicted value was 4.38, but if the ratio was 1.13 (90th percentile of the truncated Poisson dataset) it was 3.50. If a city had a dependence on intergovernmental funds of 8.44% (10th percentile) the predicted value was 4.64 while it was 3.45 if it was 26.93% (90th percentile). The number of areas of policymaking influenced by climate change mitigation was negatively associated with the number of other municipalities in the city's micropolitan or metropolitan region ($p < 0.05$ level) and positively associated with city population ($p < 0.10$ level). If the log of the number of other municipalities was 1.95 (10th percentile), the predicted value was 4.86 and the predicted value was 3.18 when that number was

5.85 (90th percentile). For city population size (in 10,000s), if it was 0.78 (10th percentile) the predicted value was 3.65 while it was 4.71 if the population was 6.03 (90th percentile).

Similar to the mitigation results, the number of areas of policymaking influenced by climate change adaptation was negatively associated with the number of other municipalities in the city's micropolitan or metropolitan region ($p < 0.01$) and positively associated with city population ($p < 0.05$). For the adaptation model output, the overall predicted value was 3.50. If the log of the number of other municipalities were 1.95 (10th percentile), the predicted value would be 4.69, while it would be 2.54 if the log of the number of other municipalities were 5.85 (90th percentile). For city population (in 10,000s), if a city's population were 0.72 (10th percentile) the predicted value would be 3.11 while if the population were 6.04 (90th percentile), the predicted value would be 4.23.

In contrast with the mitigation results, two of my variables describing the city's socioeconomic conditions – level of unemployment and median household income – both had a statistically significant positive association with the number of areas of policymaking influenced by climate change adaptation (both $p < 0.05$ level). If the city's unemployment rate was at 2.91% (10th percentile) the predicted number of areas of city policymaking that would be influenced by adaptation was 2.91, but if the city's unemployment rate was at 14.53% (90th percentile) the predicted value would be 4.36. For the city's household median income (in 10,000s), if it was 2.97 (10th percentile) the predicted value would be 2.77, but the predicted value would be 5.08 if the if the median household income was 7.59 (90th percentile).

Discussion and Implications

The analysis results presented in the preceding section model climate change mitigation and adaptation's adoption as issues influencing city policymaking and their extension across

areas of policymaking as a two-step process. I surmised that this process could not only provide an empirically-based comparison between the factors underlying these two steps, but could also enhance our understanding of the similarities and differences between cities' considerations surrounding climate change mitigation and climate change adaptation.

I hypothesized that adoption of climate change mitigation or adaptation would be associated with social changes or other crises as well as the prevailing capacity for supportive coalitions to form. My analysis provides empirical support for the notion that disruptions in the existing policy context in the form of new approaches to economic development and natural disasters are associated with the emergence of both climate change mitigation and adaptation being issues that influence at least one area of city policymaking. This is consistent with both research that socioeconomic or environmental pressure helps motivate the adoption of sustainability (Wang et al., 2011) as well as Berke & Lyles' (2013) contention that a sense of risk might facilitate the formation of constituencies supporting climate change adaptation. The extent to which economic development (or financial) pressures themselves actually factor into a prevailing sense of risk that can stimulate climate change policies in cities is a potentially fertile area of future research.

My results also provided some support for the notion that the presence of potential institutional sources for coalitions to form would be positively associated with adoption. This resonates with discussions regarding coalition formation around sustainability policy where the influence of sustainability policies is tied to the influence of environmental interests (Portney & Berry, 2014; 2016). The presence of an environmental or sustainability focused department or commission was associated with adoption for both issues, but the number of districts or wards directly electing city council members was associated only with mitigation while membership in

a sustainability network was only associated with adaptation. While most of these networks have only recently turned to promoting adaptation and have a longer and more intimate connection with mitigation (Busch, 2015; Fünfgeld, 2015), it is possible that because it is a somewhat less developed topic of city policy activity (Bulkeley, 2010; Sugar, Kennedy, & Hoornweg, 2013), the emergence of adaptation is more dependent on external encouragement. This particular conjecture is also supported by the finding that dependence on intergovernmental funding sources is positively associated with the adoption of climate change adaptation, although there was no similar statistically significant association for intergovernmental funding and mitigation. While I included intergovernmental funding dependence as a consideration about the city's political economy that might shape the number of policymaking areas influenced by the issue, in the binary model it appeared that this variable might function as an external source of inspiration for nascent interest in adaptation. Finally, while this analysis did not support the notion that a city being more Democratic party leaning would assist coalition formation around these issues, my measure of the potential for an oppositional coalition existing – the city economy's dependence on manufacturing – did have a statistically significant negative association with the adoption of mitigation. This finding is consistent with work on sustainability policy showing that, while there is little evidence that economic development and sustainability policy efforts conflict (Portney, 2013), for local action it is important that potential adversaries perceive that no such conflicts exist (Portney & Berry, 2016). At the same time, it is important to note that this region's long relationship with manufacturing may make the established presence of manufacturing a more influential factor in narrowing the space in which certain new policy issues and strategies might emerge than in other regions.

Regarding the extension of these issues across areas of city policymaking, I hypothesized that the city's political economy and conditions related to the potential size of a developing community of interest would be associated with the number of policymaking areas influenced by these issues. My analysis suggests that the more that a city's expenditures were exceeding revenue from 2006-2010, the more areas of policymaking climate change mitigation influenced. This finding contrasts somewhat with Sharp, Daley, and Lynch's (2011) study that found that fiscal stress might lead to adopting mitigation initiatives, but did not see a statistically significant relationship between fiscal stress and the extent of mitigation implementation. The cities in my study might be associating the issue of climate change mitigation with "low-hanging fruit" opportunities to improve their financial wellbeing by reducing operating costs spent on fuel and electricity to a greater extent (Betsill, 2001; Kamal-Chaoui, & Roberts, 2009). The other finance variable I included, higher dependence on intergovernmental funds, was negatively associated with mitigation influencing more areas of policymaking. This finding provides some support for the notion that cities' having more independence regarding their own decisions can lead to more dynamic responses to the emerging challenges that they face (Godschalk, 2003). The role of a city's financial and decisionmaking independence relative to higher levels of governance in the development of local climate change action is an area of study that will warrant further investigation, especially given the potential for tradeoffs evidenced by intergovernmental dependence being positively associated with the adoption of adaptation, but negatively associated with mitigation influencing more areas of policymaking.

That I did not observe a similar relationship between these financial considerations and adaptation could suggest that the cities studied don't currently see that investments in adaptation can similarly help them deal with immediate budgetary challenges. If this is the case, it would

conflict with claims that local governments will perceive that adaptation offers more immediate returns on investment than mitigation (Watkiss, Benzie, & R. Klein, 2015; Tol, 2005) – at least currently. On the other hand, while there were not any statistically significant results concerning my measures of prevailing socioeconomic conditions (unemployment, median household income, and bachelor's attainment) and the number of policymaking areas influenced by mitigation, the city having a higher unemployment rate and higher median income were both positively associated with adaptation influencing more areas of policymaking. The association between adaptation and the social deprivation indicator of unemployment implies that perhaps these cities currently perceive that adaptation is connected with pursuing new economic development strategies to a greater extent than mitigation.

The two variables describing the city's footprint in its surrounding region both had statistically significant associations with both mitigation and adaptation influencing more areas of policymaking. The presence of more other municipalities in the city's metropolitan/micropolitan area or county was negatively associated with the extension of both mitigation and adaptation across areas of policymaking – findings that were consistent with Sharp, Daley, & Lynch's (2011) analysis of mitigation implementation. Climate change mitigation in particular very clearly places cities within a collective action challenge. At a certain level of action, pursuing mitigation might make it more difficult for a city to compete economically with others and smaller cities in metropolitan areas especially will not only likely see their actual impact on the problem as minimal, but even free ride off of the emissions reductions made by surrounding larger cities (Sharp, Daley, & Lynch, 2011). The results concerning city population size being positively associated with mitigation and adaptation

influencing more areas of city policymaking provide some indication that larger cities are more likely to pursue additional activities related to climate change than their smaller counterparts.

Conclusion

In this study, I attempted to comparatively explore the factors underlying the adoption of climate change mitigation and adaptation as issues influencing city policy actions as well as the extension of this influence across areas of city policymaking. The approach for addressing this challenge that I offered here was to develop count variables that I used as dependent variables in hurdle models that could comparatively assess the relationship between sixteen independent variables and the adoption of these issues influencing city policy making (a binary outcome) and a Poisson count model of the number of areas of policymaking I assessed in the city influenced by them.

The primary finding from this study was evidence that the adoption of these issues as ones that influence the city's policy actions and the number of areas of policymaking in the city that they influenced were associated with different sets of factors. Factors related to social change, crisis, and establishing nascent coalitions were primarily associated with adoption, but the number of areas of policymaking that they influenced was primarily associated with the city's prevailing political economy and conditions related to the potential for a developing community of interest to widen.

Through doing so, I was also able to offer an empirical comparison between contextual conditions associated with the adoption and extension of climate change mitigation versus climate change adaptation. In particular, I found evidence that the adoption of mitigation (but not adaptation) as an issue influencing city policymaking was associated with more wards directly

electing city council members while adaptation (but not mitigation) adoption was associated with external influences such as participation in a multi-city sustainability network and dependence on intergovernmental funds. Adaptation adoption (but not mitigation) was negatively associated with dependence on the manufacturing sector of the economy. This contrast in the connection between economic considerations and mitigation and adaptation also emerged in the count model results where the number of areas of policymaking influenced by adaptation (but not mitigation) was associated with both a higher unemployment rate and a higher median household income. At the same time, the number of areas of policymaking influenced by mitigation (but not adaptation) was associated with factors related to the city's budgetary considerations.

Future research will be needed to discern the ways in which cities' prevailing local public economy, and their role within it, shape their decisions concerning the emergence and development of climate change mitigation and adaptation policy. In particular, qualitative research might elucidate differences in how cities even interpret the notions of mitigation or adaptation differently depending on their context. Additionally, future research on this topic could deploy more detailed measures of influence on city policymaking than those used here. This is particularly true given the connections between financial and economic concerns described here which might lead to cities to take relatively superficial actions related to climate change, but not be willing to undertake more substantive (and potentially costly) policy actions that address these issues in more depth (Bulkeley, 2010). More insight into the nature of the influence described here could also come through studies that more directly address cities' motivations underlying their interest in mitigation versus adaptation, particularly ones that incorporate qualitative methods.

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Tables

Table 1. Fifteen Policy Actions and Their Policymaking Areas Used in Dependent Variables

Built Environment
Increased building efficiency
Altered building codes
Land Use
Promoted greater development density
Promoted reuse of brownfields
Natural Environment
Increased tree canopy
Enhanced parks
Transportation
Enhanced public transportation options
Made changes to fleet vehicles
Instituted measures to increase biking/walking transportation
Energy Use
Developed alternative energy sources
Reduced city energy use
Water Management
Altered stormwater management
Altered wastewater management
Developed water recycling or reuse
Emergency Management
Altered emergency management

Table 2. Population and Survey Comparison for Selected Characteristics

	Responding Cities (n = 287; mean)	Eligible Population (n = 822; mean)
Population (in 1000s)	25.24	26.32
Bachelor's Attainment (%)	26.60	26.47
Household Income (in 1000s)	49.60	51.09

* Response rate 35%

z-tests found no significant differences at $\alpha = 0.05$

Table 3. Percentage of Cities whose Policy Actions were Influenced by Mitigation or Adaptation by Policy Area

Policy Area	Mitigation	Adaptation
Built Environment	28	19
Land Use	17	26
Natural Environment	24	22
Transportation	26	26
Energy Use	25	15
Water Management	25	15
Emergency Management	7	5

Table 4. Summary of Independent Variables

Name	Description	Source	Mean (std. dev.)
	Adoption Variables - Sources of disruption		
Development Entrepreneur	Economic development policy entrepreneur present (binary)	Survey	0.70 (0.46)
Climate Change Entrepreneur	Climate change policy entrepreneur present in the city (binary)	Survey	0.15 (0.36)
Disasters	Number of weather-based federal disaster declarations (by county) from 2000-2014	FEMA disaster declaration database	6.18 (2.84)
	Adoption Variables - Institutional sources		
Department or Commission	A department or commission present devoted to environment or sustainability (binary)	City websites	0.20 (0.40)
Wards	Number of wards/precincts/districts that directly elect councilmembers	City websites	3.29 (3.04)
Sustainability Network	Membership in a sustainabilty network (binary)	Network websites	0.08 (0.30)
	Adoption Variables - Coalition formation environmet		
Lean Democrat	Share of city vote for Democratic versus Republican candidate for president in 2012	State Secretary of State databases	5.17 (26.00)
Manufacturing Dependence	Value added in city economy of the manufacturing sector	2012 Census of Governments	1.83 (2.29)
Council-Manager Government	Whether or not the city has a council-manager form of government (binary)	City websites	0.54 (0.50)
	Extension Variables - Financial conditions		
Budget Surplus/Shortfall	City's total revenue divided by total expenditures from 2006-2010	State auditor databases	1.03 (0.08)
Intergovernmental Funds	Does the city have a council-manager form of government (binary)	City websites	0.54 (0.50)
	Extension Variables - Socioeconomic conditions		
Unemployment	The city's unemployment rate	ACS 2005-2009 5-year estimate	9.62 (3.74)
Median Income	Median household income (in 10,000s)	ACS 2005-2009 5-year estimate	4.96 (1.81)
Bachelor's Attainment	Percentage of the population who have attained at least a bachelor's degree	ACS 2005-2009 5-year estimate	26.60 (14.37)
	Extension Variables - Regional footprint		
Other Municipalities	Number of municipalities in metropolitan or micropolitan area or county (log-transformed)	2012 Census of Governments	3.77 (1.38)
City Population	City population (in 10,000s)	2010 Decennial Census	2.52 (2.99)

Table 5. Results Estimating Binary Models and Poisson Count Models

	Binary Models		Poisson Count Models	
Variables	Mitigation	Adaptation	Mitigation	Adaptation
Development Entrepreneur	1.589***	1.769***	-0.139	-0.177
	(0.37)	(0.38)	(0.16)	(0.18)
Climate Change Entrepreneur	0.648	0.675	0.061	0.053
	(0.46)	(0.46)	(0.14)	(0.15)
Disasters	0.224***	0.182**	0.015	0.029
	(0.07)	(0.07)	(0.02)	(0.02)
Department or Commission	0.912**	1.224***	0.057	-0.042
	(0.43)	(0.43)	(0.14)	(0.15)
Wards	0.145**	-0.003	0.001	0.029
	(0.06)	(0.06)	(0.02)	(0.03)
Sustainability Network	0.823	1.649**	0.096	0.209
	(0.75)	(0.82)	(0.17)	(0.17)
Lean Democrat	0.006	-0.004	-0.002	0.001
	(0.01)	(0.01)	(0.00)	(0.00)
Manufacturing Dependence	-0.091	-0.201***	-0.009	-0.006
	(0.07)	(0.08)	(0.03)	(0.04)
Council-Manager Government	0.145	-0.126	0.016	0.206
	(0.37)	(0.37)	(0.13)	(0.14)
Budget Surplus/Shortfall	0.025	-2.565	-1.464*	-0.673
	(1.93)	(1.93)	(0.83)	(0.85)
Intergovernmental Funds	0.022	0.046**	-0.018*	-0.002
	(0.02)	(0.02)	(0.01)	(0.01)
Unemployment	0.075	0.050	-0.005	0.052**
	(0.05)	(0.05)	(0.02)	(0.02)
Median Income	0.256	0.002	-0.030	0.158**
	(0.17)	(0.16)	(0.06)	(0.07)
Bachelor's Attainment	0.012	0.031*	0.003	-0.007
	(0.02)	(0.02)	(0.01)	(0.01)
Other Municipalities	-0.239	-0.100	-0.121**	-0.183***
	(0.15)	(0.14)	(0.06)	(0.07)
City Population	-0.103	-0.093	0.054*	0.063**
	(0.08)	(0.08)	(0.03)	(0.03)
Constant	-5.221**	-1.637	3.587***	1.031
	(2.57)	(2.51)	(1.05)	(1.06)
N	204	204		
Log Likelihood	-320.50	-299.40		

Note: *p < .10, **p < .05, ***p < .01.