Green American City: Civic Capacity and the Distributed Adoption of Urban Innovations[1]

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Why do some cities adopt practices to resolve social and environmental problems more rapidly and extensively than others? Although diffusion studies emphasize administrative adoption by central authorities, a range of private and public organizations are involved in the distributed adoption of innovations. The author argues that variation in the adoption of urban innovations results from persistent differences in cities' organizational communities. An econometric analysis of the geographic dispersion of green construction practices and policies demonstrates that cities with greater civic capacity, where values-oriented organizations recognize and tackle social problems, see quicker and more extensive adoption. The effect is largest early in the diffusion process because nonprofits are themselves early adopters of green construction. Municipal policies later legitimate green building, but they follow prior individual organizations. The sequential framework of distributed and administrative adoption contributes to the understanding of the institutional determinants of responses to climate change, nonprofits as catalysts of urban innovation, and the consequences of urban governance on an intercity scale.

Cities are at the forefront of adopting novel practices and policies designed to address contemporary social and environmental problems (Glaeser 2011; Schragger 2016; Romero-Lankao et al. 2018). The diffusion of urban innovations is, however, characterized by durable geographic variation,

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as disparities in cities' uptake of new practices and policies for climate change mitigation illustrate (Portney 2003; Vasi 2007; Bulkeley 2013; Cole 2015; Klinenberg 2015, 2016). Although green construction, modern waste and water management, and transport electrification are often first adopted in cities, many city governments ignore their outsized impact on the environment (Betsill and Bulkeley 2007; Hoffmann 2011). Climate change mitigation is no exception to the fact that many cities adopt innovations late, superficially, or not at all (Bulkeley 2013).

What explains geographic differences in the timing and extent of the adoption of urban innovations? Any explanation must confront a sociological conundrum. Studies of intercity diffusion emphasize *administrative adoption*, in which local governments exercise authority by enacting formal policies such as laws or ordinances (Tolbert and Zucker 1983; Martin 2001; Vasi and Strang 2009; Steil and Vasi 2014). But the view that local governments determine city practices assumes that cities are directed by central decision-making bodies, akin to a corporate board of directors (Still and Strang 2009). Work on urban governance posits that cities cannot be reduced to the actions of a city council or administration (Levine 2016, 2021; da Cruz, Rode, and McQuarrie 2019; Marwell, Marantz, and Baldassarri 2020). Cities are better understood as complex networks of public and private organizations that are collectively involved in governing the city through ongoing negotiations (see Dahl 1961; Marwell 2007; Pierre 2014).

Applying urban theory to the problem of how innovations spread among cities, I argue that many innovative practices are adopted collectively and piecemeal by decentralized organizations rather than only centrally and all at once by some authority. *Distributed adoption* refers to the uptake of a practice by a network of organizations in a city, including firms, associations, and public agencies. I hypothesize that the adoption of urban innovations, including those that bear on climate change, is a joint product of both distributed and administrative processes. This means that cities' adoption of innovations results from collective organizational behaviors that are themselves embedded in the larger social forces that characterize a city and cannot be reduced to public policy or the choices of central authorities alone (Marwell 2007).

Administrative adoption is typically seen as resulting from government and firm susceptibility to political and social movement pressures (Strang and Soule 1998; Schneiberg and Soule 2005; Briscoe and Murphy 2012).

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I argue that distributed adoption, in contrast, is due to differences in the civic capacity of cities stemming from values-driven organizations that recognize social problems and initiate solutions for them. Civic capacity reflects structural differences in the propensity for collective action, volunteering, and trust. Unlike community social capital, however, civic capacity operates via the actions of formal organizations (Rao and Greve 2018). As values-driven components in a city's "web of life," nonprofits can be catalysts for urban innovation (Park 1915; Safford 2009; Sampson 2012; Brandtner and Dunning 2020). By taking risks in response to the emergence of new practices, nonprofits establish proofs of concept. These then encourage governments to legitimate new practices via public policy, which in turn prompts widespread local adoption by organizations not under the control of the city government. By these means, civic capacity facilitates both distributed and administrative adoption of novel practices in cities.

To develop a theoretical model of the effect of civic capacity on regional variation in the timing and extent of new practices among cities without reducing urban innovation to the binary adoption or nonadoption of a policy, I build on two sets of organizational scholarship. Research on policy diffusion among nations, states, or cities emphasizes that organizational features can increase their susceptibility to surrounding ideas (Tolbert and Zucker 1983; Vasi 2007; Sine and Lee 2009; Negro, Carroll, and Perretti 2013). This line of work provides important insights on the timing and conditions of the initial adoption of a policy or practice, but it rarely examines implementation failures (Kalev, Dobbin, and Kelly 2006; Soule and King 2006). A second set of studies investigates how practices and policies spread within a community of organizations (Greve and Rao 2012; Marquis, Davis, and Glynn 2013; Rao and Greve 2018). Theories of organizational communities acknowledge extensive differences between places, but then they neglect when and how organizations establish new practices that later become institutionalized by default. Both perspectives indicate the importance of a place's civic capacity in opening its windows to the winds of change. Taken together, they offer a complete picture of how individual organizational behaviors determine the timing and extent of collective adoption (Soule and Zylan 1997).

I test this organizational framework for administrative and distributed adoption in the context of climate change by studying the emergence of energy-efficient construction, which is one of the most important innovations for the greening of American cities. Energy-efficient construction is vital for climate change mitigation (Pacala and Socolow 2004). The U.S. Geological Survey estimates that energy use in buildings is responsible for 40%–70% of U.S. total use, and their regulation is largely local. Green construction is thus a central strategy by which cities have addressed their environmental footprint (Trisolini 2010). Conceptually, green construction showcases how differences in local institutions can condition climate action through existing

technologies (Pacala and Socolow 2004; Pellow and Nyseth Brehm 2013; Hironaka 2014; Jerolmack and Walker 2018; Klinenberg, Araos, and Koslov 2020). The choice to adopt green buildings is not limited to the administrative fiat of city hall. Adoption may also come from distributed commitments by the city's population, including energy-efficient construction of homes, hotels, museums, libraries, and office buildings.

To track the origins and spread of green construction among U.S. cities, I combined the universe of green building certifications aggregated across 11,663 U.S. places between 2000 and 2016 with rich data on the organizational, social, and political ecosystem in each. I find that places with greater civic capacity adopt green construction regulation sooner than others and exhibit more green building certifications. This association is strongest when green building certification is first initiated. To a lesser degree, it persists through the enactment of public policy and as corporations scale up green construction. Corporations are responsible for most adoptions overall but follow the initiative of civil society and local government. This temporal sequence points to civic capacity as an important catalyst for urban innovation as a collective process.

Avoiding the reduction of cities' complex behavior to the actions of a central authority or to a private network of firms contributes to three lines of inquiry. First, it establishes how organizations and institutions matter for understanding variation in local innovative environmental practices. Second, by these means, I illuminate how civic capacity enables practice diffusion within and between cities, in part through the contributions of nonprofit organizations as catalysts of not-yet-legitimated novel practices. Finally, the article provides a process model of urban governance for cities' embrace of new practices and policies.

ADMINISTRATIVE AND DISTRIBUTED ADOPTION OF URBAN INNOVATIONS

City as Adopter of Innovation

Cities respond to crises, take responsibility for their citizens, or implement novel technologies by developing new practices or policies (or abstain from doing so). This is not a trivial observation, as the adoption of innovations can change cities' position in the social fabric vis-à-vis informal communities (Douglas 2018) or states (Brenner 2004; Clemens 2010). Seeing city governments as the locus of innovation is at odds with their limited legal autonomy as "creatures of statute" (Peterson 1981; Frug and Barron 2013; Brandtner et al. 2021). Urban theory suggests several reasons why the assumption that adoption decisions are in the hands of local government constitutes "methodological cityism" (Angelo and Wachsmuth 2015).

Understanding cities by analogy to social actors like individuals or organizations trivializes decision making in urban politics. Cities are units in which

governance actors adhere to predefined decision-making processes in spite of having an elected government. The complexity of city decisions with impacts on individuals, groups, and communities is well documented (da Cruz et al. 2019; Marwell et al. 2020, p. 1560). The idea of urban governance builds on foundational insights in urban sociology with respect to how political coalitions (Dahl 1961), urban regimes (Mollenkopf 1983; Stone 1993; Mossberger and Stoker 2001), and networks (Safford 2009) influence agenda setting, decision making, and the implementation of urban policy (see Marwell and Morrissey [2020] and Marwell et al. [2020] for thorough reviews).

Further, the decision to adopt a practice or policy does not emerge from the aggregation of atomic intentions of elites, such as mayors or business leaders. As "intricate, overlapping systems of inter-organizational relationships" (Safford 2009, p. 5), cities are less hierarchies than networks of people and organizations (Park 1915; Laumann, Galaskiewicz, and Marsden 1978; Powell, Koput, and Smith-Doerr 1996; Powell et al. 2005; Whittington, Owen-Smith, and Powell 2009). Thinking of the city as a network raises the question of how a medley of interests and viewpoints translates into coordinated action, such as in adopting an urban innovation, particularly as government has a receding influence on urban governance (Marwell 2004; Bevir and Rhodes 2006; Guthrie and McQuarrie 2008). Similar concerns on collective decision making motivated initial debates on coalition building and community power in urban politics (Hunter 1953; Dahl 1961; Mollenkopf 1983; Levine 2021).

Additionally, portraying a city as a discrete actor raises the suspicion of the ecological fallacy. The idea that official government policies trickle down to form individual behaviors is often faulty, and implementation of the intentions of city administrations is often decoupled from the stated and actual goals (Meyer and Rowan 1977; Bromley and Sharkey 2017). Because cities are fragmented into many interrelated collectives, they have no a priori actorhood of the kind that sociologists may ascribe to an individual or organization (King, Felin, and Whetten 2010). Instead, the perception of agency is culturally constituted by observers' institutionalized beliefs, and these beliefs can have multiple cultural bases (Berger and Luckmann 1966; Meyer and Jepperson 2000; Bromley and Meyer 2015). As a result, theories of urban governance and interorganizational networks indicate a problematic confounding between scales as a core problem of studying adoption on the city level.

Administrative and Distributed Adoption of Urban Innovations as Outcomes

Taking the organizational dimension of urban governance seriously promises a more refined theory of the adoption of innovative practices through

and in cities. I therefore argue that it will be fruitful to distinguish between administrative and distributed adoption as outcomes of dynamics of urban governance. This differentiation adds theoretical heft to the social meaning of adoption as a collective process that spans multiple actors. Taking the actions of multiple organizations into account makes the interplay of private and public sectors empirically tractable.

Administrative adoption is enacted by city governments and other organizations that exercise central authority on behalf of the city, for example, through elections or elite approval. Administrative adoption—including policies or ordinances passed by municipal governments—is the predominant outcome of interest in studies of the adoption of policies by cities. For instance, Martin (2001) examines the effect of federalist government structures and the labor movement on the diffusion of local living wage laws. Vasi (2007, p. 114) examines the endorsement of the Cities for Climate Protection Program by local governments in North America and Australia, describing this as "the adoption of an organizational program . . . by local government." Vasi and Strang (2009) examine the adoption of municipal civil rights legislation that protects the privacy of citizens in the wake of the Patriot Act. Steil and Vasi (2014) study how political allies and local immigrant organizations affect cities' propensity to adopt immigrant-friendly ordinances, such as Sanctuary City rules.

Administrative adoption captures the notion of city power, which, according to Schragger (2016, p. 1), comprises both the "formal authority to engage in particular activities" as well as "the city's actual capacity to govern—its ability through its policies to improve the material well-being of its citizens." Studies of administrative adoption place exclusive emphasis on formal acts, such as signing an agreement or passing an ordinance. In many cases, however, formally designated custodians are not the ones who choose to adopt a practice or policy on behalf of a place; instead, practice adoption is dependent on actions taken by many widely distributed individuals and organizations. A simplistic application of the idea of adoption as a response to shared coercive, normative, and mimetic influences to city authorities would suggest that cities are becoming increasingly similar to each other (DiMaggio and Powell 1983; Tolbert and Zucker 1983; see McQuarrie and Marwell [2009] for a critique). This assumption would be misleading, however, because not all individuals within a city are bound by the same constraints, and not all cities impose the same constraints on their residents. To evade this problem, I expand the analytical toolkit to include distributed adoption.

Distributed adoption describes the culmination of adoption behaviors exhibited by the individuals and organizations that constitute the urban community. If administrative adoption highlights policies that can encourage a reduction in carbon emissions, distributed adoption accounts for whether corporations, homeowners, nonprofits, and public agencies discourage waste,

use renewable energy, and invest in better insulation to reduce energy use and whether individuals bring their own containers or switch off the lights when they leave their homes. From a distributed view, adoption at the macrolevel stems from the aggregation of many individual adoptions on the microlevel. When individual actors share a consensus on the value of their actions, even their potentially uncoordinated activities can create the impression of coordination, regardless of the possibly heterogeneous motivations of the adopters. An example of this kind of distributed adoption can be seen in the cultural-cognitive cohesion of beliefs about appropriate business practices that arguably explains regional concentrations in patterns of corporate social responsibility (CSR; Marquis, Glynn, and Davis 2007; Marquis and Battilana 2009). Such isomorphic behavior may be the result of mimicry without central coordination, for example, through board interlocks (Mizruchi 1996).

To be sure, distributed adoption does not occur in isolation from the central authority of local administrations; it is neither all private nor even fully decentralized. Distributed adoption can be understood in analogy to distributed innovation, in which innovation emanates not from the manufacturer of a product but from many sources at once, including users and rivals. Open-source software is an example of such a distributed system. Although distributed systems span an ecosystem of actors, they often feature a key developer (e.g., Linus Torvalds as the leading developer of Linux). They are also often critically supported by governmental funding, convening, legitimation, and even active development.[2]

Diffusion between and within Places as Process

How can this distinction help clarify differences in cities' propensity to adopt practices and policies aimed at solving social and environmental problems? Theoretically, administrative and distributed adoption parallel research on diffusion between places (such as interstate diffusion) and within communities of organizations (such as in a metropolitan areas) at the intersection of social movement research and organizational sociology (Davis et al. 2005; Schneiberg and Lounsbury 2017). Previous research emphasizes either the spread of practices among city governments (administrative) or the spread of practices among individual people and organizations within cities (distributed).

[2] Other conceptual analogies include distributed computing in computer science (a system whose components are located on different network computers, such as cloud computing) and distributed cognition in cognitive psychology (a process in which cognitive resources are shared socially to achieve what an individual agent could not achieve alone, such as collaborative tagging of images).

To investigate the former, scholars of diffusion among communities have highlighted the spatial patterns that appear in the timing of adoption and common institutional pressures that explain these patterns (Tolbert and Zucker 1983). Policy diffusion studies focus on the initial adoption of a phenomenon and de-emphasize both nonadoption and the extent of adoption (Strang and Soule 1998). One challenge in such models is that the adopted policies do not always transform actual practice. Many policies, practices, and structures are adopted symbolically without any change to everyday practices (Meyer and Rowan 1977). More importantly, when a place adopts a new practice (or adopts the policy to require it), that practice may not spread throughout the place's population. For instance, a state or city may pass a new incentive such as a tax credit, but organizations in that place may also refrain from taking it up (Guthrie and McQuarrie 2008).

Studies of diffusion within communities of organizations provide the flip side to this argument, as they emphasize the role of private organizations in the uptake of practices in a community in relation to economic development and democratic governance. Galaskiewicz (1997) identifies lasting cultural norms on giving, which shaped corporate philanthropy in the case of the Twin Cities. As Safford (2009) finds, the network structure of a community can determine its ability to coordinate economic collaboration, which has facilitated the renewal of some Rust Belt cities, such as Allentown, Pennsylvania (also see Pacewicz 2015). Marquis and colleagues, similarly, find that organizations within a community are imprinted through their community membership. Consequently, organizational behavior within regions tends to cohere strongly. For instance, metropolitan regions covary in their propensity for CSR because of shared cultural pressures, which apply to all organizations in a community, not only to businesses (Marquis et al. 2007; Longhofer, Negro, and Roberts 2019). The primary outcome in these studies is the probability or extent of adoption rather than their timing. Estimating the extent to which a practice has been adopted within a place independent of first adoption is a challenge, in that common models of diffusion consider widespread adoption to be the second stage in a two-step model. Moreover, most work on practice spillovers within communities selects cases in which a practice is initially successfully adopted.

Taken together, understanding both which cities see adoption of a practice first and which organizations within a community take up that practice can identify the geographic and temporal patterns of the adoption of urban innovations. The processes of diffusion between and within communities are clearly interrelated. For instance, social movement scholars have indicated that between-polity considerations influence within-polity processes. McAdam (2005) acknowledges that international relations during the Cold War put pressure on the U.S. federal government to confront the treatment of African Americans, which contributed to the political opportunity structure

that made the Civil Rights Act possible. Soule and Zylan (1997) find that work requirements in the Aid to Families with Dependent Children programs were adopted in response to intrastate pressures but spread via cultural and institutional linkages between states. The authors' insight that "the lack of discourse between the two schools [is] unnecessarily limiting and somewhat perplexing" (p. 757) remains true at a local level of analysis. The timing and extent of a new practice are best understood as a product of administrative and distributed processes.

CIVIC CAPACITY AS CATALYST OF URBAN INNOVATION

As discussed above, sociological theories of policy diffusion center the act of adoption in government offices, whereas studies of organizational communities highlight the initiative of private actors. Rather than focusing on either governments or private organizations, my framework of administrative and distributed adoption suggests that the locus of innovation is the network of organizations that comprise the city. From organizational approaches to understanding geographic variation in diffusion, whether within or between places, I draw the insight that structural conditions can facilitate adoption (Strang and Meyer 1993). Potential adopters, be they nation-states or organizations, are more susceptible to changes that appear in their wider environment when internal activists or professionals work to attune them to these changes (Frank, Hironaka, and Schofer 2000; Schneiberg and Soule 2005; Briscoe and Murphy 2012). Applying this general insight to the city, I argue that persistent differences in the civic capacity of cities facilitate both the distributed and administrative adoption of urban innovations.

Civic Capacity and Initiation of Urban Innovation

Cities show structural differences in their ability to foster civic engagement and to mobilize citizens for social change. These differences in civic capacity are reflected in the presence and diversity of local nonprofit organizations (Marwell 2004; McQuarrie and Krumholz 2011; Marwell et al. 2020). Nonprofit organizations are a strong corollary of place-based differences in recognizing and organizing ostensible solutions to social problems that characterize civic capacity.[3] Nonprofits bolster local resilience and provide resources

[3] Civic capacity may also be connected to the presence of organizations that do not carry the label of nonprofit organizations common to the United States, such as associations and nongovernmental organizations. Furthermore, organizations other than nonprofits can engage in "coordinating action to improve some aspect of common life in society, as they imagine society," as Lichterman and Eliasoph (2014, p. 809) astutely note; nonprofits can engage in multiple strategies to do so, only some of which are purposely aimed at introducing innovations (e.g., the scene style of "nowtopianism" identified by the authors).

for the creation of social capital, for instance (Small 2004; Klinenberg 2015, 2018). Clifford (2018) finds that enduring differences between nonprofit organizations are a sign of neighborhood deprivation in England, because affluent neighborhoods see more charities founded, and there is a lower hazard of their dissolution. A longitudinal study of Chicago found that the number of nonprofits in a neighborhood predicts significantly more civic action (Sampson et al. 2005). Nonprofits also support the civic capacity of marginalized populations (de Graauw, Gleeson, and Bloemraad 2013). The authors of these studies propose a series of direct mechanisms for civic capacity, such as the creation of social capital, the dissemination of civic skill, and the development community-oriented programs (Verba, Schlozman, and Brady 1995; Putnam 2000).

Despite the emphasis in the literature on individuals and communities, civic capacity also operates through organizational channels (Sharkey, Torrats-Espinosa, and Takyar 2017). For instance, Rao and Greve (2018) find that the diversity of local nonprofit organizations dampened the adverse impact of the Spanish flu on communities' ability to form retail cooperatives in early 20th-century Norway. Scholars have also previously highlighted how cultural beliefs and toolkits shape society. As organizational fields, cities are subject to shared, external cultural influences that shape their behavior (Marquis and Battilana 2009). The actions of cities do not take place in a social vacuum but in response to external institutional pressures (Soule and Zylan 1997; Brandtner and Suárez 2021). Cities' embeddedness in an institutional environment influences the form and content of how local organizations behave (DiMaggio and Powell 1983). In recent work on the effects of nonprofits on cities, institutional aspects play second fiddle to direct interventions that can be modeled with greater methodological sophistication. Acknowledging both structural and organizational effects, I propose that civic capacity can have a positive effect on distributed adoption—understood as the taking up of new practices by individual organizations located in the city.

Hypothesis 1.—*Civic capacity will increase the likelihood and extent of the distributed adoption of urban innovations.*

Temporal Dynamics of Civic Capacity

When does civic capacity enable the adoption of urban innovations? I argue that civic capacity is particularly important for stimulating distributed adoption in the initiation phase, when no default solution for a problem has yet been established. This is for two reasons. First, members of civil society introduce novel ideas to solve established social problems. The social movement literature shows that local organizations increase the susceptibility

of places to social innovation (or challenging policy proposals) by pulling in ideas from the wider environment (Strang and Soule 1998; Briscoe and Murphy 2012). Schneiberg and Soule (2005), for instance, claim that organizations can trigger community action by introducing new ways of thinking, fueling contention, and provoking legitimacy crises. This effect is not particular to social movement organizations in the narrow sense. As Vasi and Strang (2009) show, a pluralistic ecology of different local organizations that advocate on behalf of a policy issue—such as American Civil Liberties Union offices and movement chapters—has an additive effect on the adoption of civil rights legislation. Commercial organizations can also contribute to the susceptibility of a place, as Negro et al. (2013) show in the context of LGTBQ (lesbian, gay, transgender, bisexual, and queer) rights ordinances in U.S. counties. Goldstein (2018) finds that different features of community organization contribute to a "social ecology" that affects nonoccupancy investment in U.S. counties. Local organizations can serve as receptors for the adoption of certain practices.

Second, as organizations without a profit motive are motivated by value rationality rather than instrumental rationality, they are often early movers on costly and voluntary initiatives (DiMaggio and Anheier 1990; Clemens and Powell 1998; Marwell and McInerney 2005; Barman 2016). Nonprofit organizations and public agencies may therefore lead distributed adoption early on because they believe in the value of an action regardless of its immediate payoffs. Corporations and investors, however, may scale up distributed adoption once a scheme is linked to salient material and social rewards, such as legitimacy vis-à-vis stakeholders. Compared to private industry, the nonprofit sector is small (employing 11.7% of all private sector workers according to the Bureau of Labor Statistics; see Bishow and Monaco 2016). As soon as distributed adoption develops momentum, the marginal influence of early adopters thus recedes. This dynamic is consistent with the diffusion patterns of civil service reform among U.S. cities in the early 20th century (Knoke 1982). As Tolbert and Zucker (1983) found, initial adoption of the manager-council structure was determined by demographic properties of the city. Once a practice became institutionalized by consultants and think tanks, however, the characteristics that determined initial susceptibility to the new practice became less important.

Hypothesis 2.—*Civic capacity will have a larger effect on distributed adoption during the initiation stage than in later stages of diffusion.*

Scaling through Administrative Adoption of Urban Innovations

Another channel through which civic capacity can be linked to distributed adoption is in the passage of formal policies by central authorities, or

administrative adoption. Even though individual organizations can be encouraged by civic leadership, they have no legitimate authority to dictate urban policies in isolation from the local regulatory environment. The case of corporate diversity standards, for instance, suggests that the primary reason why a majority of conservative organizations adopt social or environmental practices is that they are incentivized or required to engage in certain social or environmental practices, regardless of how enthusiastically they ultimately embrace said requirement (Dobbin 2009). As Sine and Lee (2009) identified in their analysis of the emerging wind-energy sector, furthermore, the social resources provided by social movements such as the Sierra Club can have both direct and, through legislation, indirect effects on entrepreneurial activity. As shown in the policy diffusion literature, civic capacity can be a critical factor for the adoption of public policies (Martin 2001; Vasi 2007; Vasi and Strang 2009; Steil and Vasi 2014).

The link between civic capacity and administrative adoption is, in turn, important for the understanding of distributed adoption. Interactions between distributed and administrative adoption may explain expedited growth and cascade effects that occur after the period of early adoption. Rather than thinking about policy as an alternative cause of private behavior, it is best understood as a channel through which institutional differences between cities lead to divergent outcomes in a city's dominant practices. Institutional pressures lead governments to design policies that then constrain individual actors in coercive isomorphism. A plethora of tax incentives and other government policies explain the scaling effects among corporations in particular, as such policies offer a "mode of reproduction" that creates legitimated solutions for shared concerns (Guthrie and McQuarrie 2008; Colyvas and Jonsson 2011, p. 43).

The entanglement of practice and policy suggests that distributed adoption both follows and precedes administrative adoption. Diffusion research assumes that policy diffusion is determined externally and is antecedent to individual uptake of the practices it requires (Strang and Meyer 1993). In reality, however, private organizations often take the lead in adopting new practices rather than waiting to be coerced. There are multiple plausible mechanisms for this. One is anticipatory obedience, that is, when regulatory threats cause firms to respond to the demands of a social movement before those firms are targeted (McDonnell and King 2013). A complementary source of scaling through a policy loop is the observation that early adopting organizations establish a proof of concept that then facilitates the passage of a policy. Municipal government can legitimate small wins and trailblazing efforts through administrative adoption—such as through legislation or other policies that encourage individual practices. Corporations play a critical role by scaling previously institutionalized practices, while civic influences tend to recede as a practice enters the mainstream.

HYPOTHESIS 3a.—*Cities with higher civic capacity are more likely to engage in the administrative adoption of urban innovations.*

HYPOTHESIS 3b.—*Cities that already see distributed adoption are more likely to engage in the administrative adoption of urban innovations.*

HYPOTHESIS 3c.—*Administrative adoption will legitimate and thus increase subsequent distributed adoption of urban innovations.*

GREEN CONSTRUCTION AS THE ADOPTION OF URBAN INNOVATIONS

Certifying Green Construction

Green construction is a substantively important and theoretically apt case for studying the conditions of administrative and distributed adoption. The market volume of nonresidential green construction, which focuses on improving the energy efficiency of buildings, is valued at around $120 billion in the United States alone and has been growing rapidly, at around 12% per annum.[4] Green construction is a dominant urban strategy for mitigating emissions. Although some states have imposed regulatory floors, building codes are almost exclusively in the domain of municipal governments. Legal preemption by states, which is routine in the context of taxation or emissions regulation, is minimal in construction (Peterson 1981). Building codes are also relatively standardized and follow model codes such as those of the International Code Council.

Environmental issues are addressed uniformly in building codes. "Where local governments have adopted green building programs," Trisolini (2010, p. 703) states in an analysis of local climate change regulation, "the vast majority have employed the LEED program." LEED is the leading certification system for green buildings, developed by the U.S. Green Building Council (USGBC). LEED has become the standard for new construction (and increasingly for the operation and retrofitting of existing buildings) since the inception of this certification protocol at the turn of the century. Green buildings are a low-cost climate change mitigation strategy whose

[4] The compound annual growth rate is estimated using a market volume of $120 billion in 2018 (Dodge Data and Analytics 2015, p. 8). The nonresidential market provides insight into the progression of this growth. Between 2005 and 2008, this market grew from $3 to $25 billion. Overall, nonresidential construction contracted from $212 to $154 billion during the economic crisis; green construction continued to grow from $25 to $48 billion, increasing its market share from 12% to 31%. Projections estimate that at $119–$134 billion, today's market share is roughly half the nonresidential construction market, and it continues to grow. Green building is also estimated to have created 1.1 million jobs, 386,000 of which were directly attributed to Leadership in Energy and Environmental Design (LEED), adding $26.2 billion in wages (Booz Allen Hamilton 2015).

greatest challenge to implementation is weak incentives among potential adopters (Pacala and Socolow 2004; Brown and Southworth 2008). This raises the question of who adopts LEED and when they do so.

Stages of LEED Adoption

Similar to other technologies, green construction spread sequentially throughout the United States (Rogers 1983). Figure 1 shows a steep increase over time in new registrations for LEED certification. More than three-quarters of all LEED buildings have been constructed after 2009, and only 3.2% of were constructed in 2006 or earlier. Building-level data indicate three stages for the diffusion of green building certification in U.S. cities: initiation, with a total of 336 cities that saw at least one LEED-certified construction project (2002–6); rapid expansion, in which organizations in 351 additional cities registered in just three years (2007–9); and lagged adoption, in which another 110 cities saw their first LEED project (2010–15). In 2015, only five cities experienced a first-time registration. The resulting S pattern of new

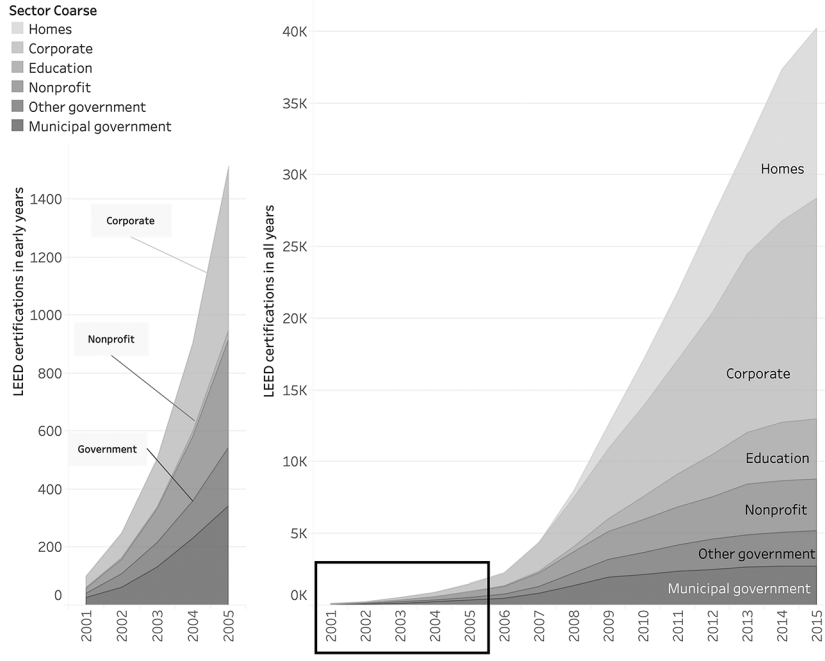

FIG. 1.—Cumulative LEED registrations by year and sector in the United States

adoption in cities, as depicted in figure 2, suggests that very few city regions will now take up LEED de novo.

Figure 1 confirms the conventional understanding that LEED certifications are, on the aggregate, driven to a large degree by businesses (York, Vedula, and Lenox 2018). Following the initiation stage in particular, ending around 2006, corporations make up the lion's share of entities that register new construction projects with the USGBC. By 2006, LEED had become a legitimate approach to green building, and experts (such as LEED accredited professionals) spread the practice (Jones et al. 2019). The rapid expansion of LEED certifications among corporations after 2008 may also be driven by the need for reputation repair by banks and other organizations in the finance, insurance, and real estate industries. As one executive of the USGBC explained in a background interview, the financial crisis provided "a boost" for the certification protocol because, presumably, corporations could use their buildings' certification to publicly advertise their prosocial orientation. In the final scaling stage, financial districts have particularly high concentrations of green building certifications.

Analyzing all stages of adoption and not focusing only on the aggregate reveals that different organizations characterize different phases. In the initiation stage, the relative share of nonprofit and public organizations adopting LEED exceeds that of corporate adoptions. This is a critical insight

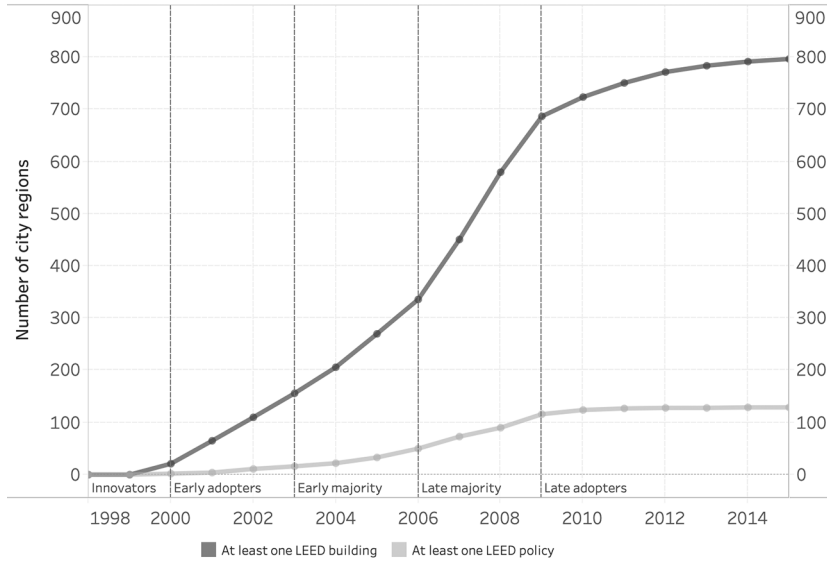

FIG. 2.—Diffusion of LEED green building registrations and policies by year among 927 U.S. core-based statistical areas.

because the geographic diffusion of buildings throughout the United States became locked in around 2006 and remained stable during the later scaling stages, when most corporate adoptions occurred. Figure 3 illustrates the solidification of this trend. At present, LEED is widely disseminated, and corporations may pursue green building certifications to boost their legitimacy or minimize their tax burden.

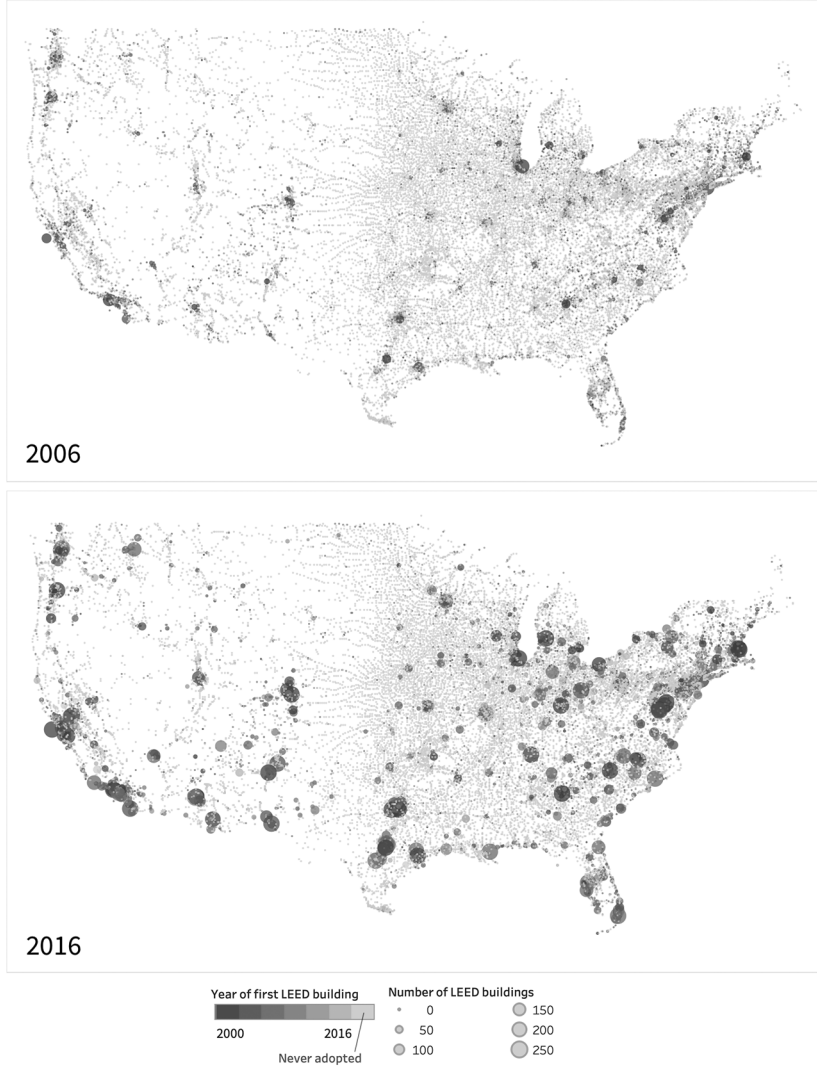

FIG. 3.—Map of cumulative LEED registrations and year of first LEED registration in the contiguous United States, 2006 and 2016.

By contrast, patterns of early adoption cannot be explained through standard accounts, which would suggest that organizations adopt LEED certifications because they generate a symbolic or material payoff. At that point, debates over whether the causal benefit of this certification served the end of energy and cost efficiency had not yet been settled. Previous research is inconclusive regarding the actual savings stemming from the energy efficiencies of LEED-certified buildings compared to buildings that barely failed certification (Matisoff, Noonan, and Mazzolini 2014; Amiri, Ottelin, and Sorvari 2019). Still, 76% of 1,026 construction professionals surveyed viewed cost savings as the primary reason for green building (Dodge Data and Analytics 2016). For corporations, government agencies, and nongovernmental organizations alike, obtaining green building certification is a way to signal support for the natural environment, even if this support is largely symbolic: 74% of the same group of professionals indicated their desire to encourage sustainable business practices was a key motive. Whether certification is causally related to greater efficiency due to selection effects or not, LEED-certified buildings use two-thirds of the energy of noncertified buildings (Trisolini 2010, p. 704).

Explaining Green Building

Applying the framework of administrative and distributed adoption to the study of geographic variation of green construction suggests that civic capacity increases the propensity for the adoption of green construction through the interplay of public LEED policies and individual LEED certification activity. The spread of LEED maps onto a sequential model of distributed and administrative adoption, spanning the initiation, legitimation, and scaling of the new practice. I hypothesize that cities with greater civic capacity see both distributed adoption through individual certification activity and administrative adoption through public policies that encourage or require individual certifications. The effect of civic capacity on distributed adoption is expected to be larger during the initiation stage than later. Public policy is encouraged by individual certification activity in the initiation stage; in turn, it legitimates subsequent certification activity among laggards.

This organizational framework overcomes the challenges of understanding the social actions of cities outlined above in three generative ways. First, this study does not only focus on overall adoption levels but traces the shifting locus of action over time. Considering how green building certifications are adopted by individual organizations provides insight into who drives adoption within in a community rather than conceptualizing the city as the adopter (York et al. 2018). The identification of the organizations that are responsible for the different aspects of the uptake of green construction

is a prerequisite for assessing climate change–related activities as a distributed, collaborative process in the community. Early dynamics are particularly relevant given the stickiness of the initial geographic distribution as a source of later spillovers (see fig. 3). As a result, local dynamics matter even net of the social forces stemming from national and global governance (Brenner 2004; Schragger 2016; Brandtner and Suárez 2021).[5]

Second, given that LEED certifications pose real restrictions on construction projects, they serve as indicators of material rather than mere symbolic actions, such as announcing a commitment to register greenhouse emissions or devising a climate action plan (Vasi 2007; Millard-Ball 2013). Despite the promised savings associated with long-term energy efficiency and potential reputational gains, green construction and its certification incur immediate costs to adopters. Beyond the certification fee itself, construction-related expenses "can increase a project's cost by about 10 to 30 percent" (Vamosi 2011). Examining cases of costly implementation allows analysis to go beyond superficial, symbolic commitments (Frank et al. 2000; Schofer and Hironaka 2005; Bromley and Meyer 2015).

Third, research on the differential diffusion of novel practices typically focuses on a binary dependent variable (e.g., the adoption of a reporting requirement such as carbon disclosures or a law, such as a municipal bill of rights), which allows for the theorization of factors that determine the timing of adoption before a policy is adopted. By contrast, this study takes into consideration the extent of individual actions, in the both the pre- and postpolicy stages (Schumaker 1975; Soule and King 2006). By considering both the timing and extent of adoption, this study does not artificially separate the questions of the origins and spread of a practice. Instead, it illuminates both intertwined aspects of the adoption of urban innovations.

DATA AND METHODS

Research Design

This study traces the adoption and growth of (1) registrations for LEED green-building certification and (2) municipal policies encouraging or requiring LEED certifications for new construction from 2000 to 2016,

[5] To be sure, climate efforts in different domains—such as wastewater management or public transportation—may follow geographic patterns different from those of green construction. An analysis of over 1,700 responses to a 2010 survey among municipal governments conducted by the International City and County Management Association (ICMA) showed that there is high correlation among a battery of 64 different sustainability municipal practices (Cronbach's $\alpha = .83$). Furthermore, of the 30 cities with the highest number of LEED certifications, 29 have signed the "We're Still In" pledge reaffirming a municipal commitment to the Paris Climate Accords, compared to under 40% for the total population of cities above 25,000 people.

starting with the first year that a building was LEED certified. Building data are drawn from the public LEED project directory, which includes a total of 105,318 registrations for green-building certification, 55,954 of which were successful as of 2016. Using ZIP codes, buildings were aggregated to the universe of census places that have independent, incorporated local governments, including cities, towns, villages, and boroughs. To consider regional dynamics and properties of multiple places within a single metropolitan or micropolitan area, all places are nested within a county, core-based statistical area (CBSA), and geographic region. The resulting data set spans all U.S. municipalities, excluding nonincorporated and rural places. Data on the organizations present at every census place were drawn from the National Center for Charitable Statistics (NCCS), Compustat, and MSCI KLD. Robustness checks included additional measures of the organizational ecosystem for higher education from the Integrated Postsecondary Education Data System (IPEDS), social movements (Dynamics of Collective Action), and community-oriented businesses (NRDRC). Table 1 provides statistics for the populations of the places in the study. I also conducted 22 background interviews with city sustainability officials, USGBC executives, and project owners as part of a qualitative investigation of the organization of city climate action. (The quotes in the results section below come from these interviews; individuals' names are not shared in the interests of confidentiality.)

Measures

LEED certifications.—The primary dependent variable is the timing and extent of individual organizations' green-building certifications by place as an indicator of distributed adoption. On average, 700 days pass from registration with the USGBC to time of certification. Because the outcome of those interested is best reflected in the intention to apply and to account for varying lags between registration and certification, I focus on the number of registrations in a given city per year. Each building is attributed to a sector based on a USGBC classification: governmental (municipal and other), nongovernmental nonprofit, corporate, educational, and homes. Because sector affiliations are self-reported, I validated and corrected them by hand individually and then aggregated the microdata to the place level. I performed secondary analyses, including the duration of the certification process, the level of accreditation, the average achieved score, and the percentage of successful certifications per applicants in each place.

LEED policies.—The presence of a green-building policy in a municipality indicates administrative adoption. All 428 municipal policies passed since 2000 are linked to the corresponding municipality instead of being

TABLE 1
DESCRIPTIVE STATISTICS FOR 11,663 U.S. PLACES, 2002–15

	N	Mean	SD	Min	Max
USGBC Project Directory:					
Any LEED building	163,169	.31	.46	0	1
Year of first LEED building	50,628	2,007.51	3.30	1,999	2,015
Buildings in $t + 1$	163,169	.38	5.23	0	649
By government in $t + 1$	163,169	.04	.45	0	48
By corporations in $t + 1$	163,169	.13	1.88	0	206
By homeowners in $t + 1$	163,169	.12	3.51	0	481
By nonprofits in $t + 1$	163,169	.03	.41	0	53
Platinum in $t + 1$	163,169	.03	.82	0	112
Previous buildings in state	163,169	79.96	186.46	0	2,651
USGBC policy library:					
Any LEED policy	163,169	.02	.15	0	1
Year of first LEED policy	3,870	2,007.80	2.31	2,000	2,014
Policy (incentive)	163,169	.01	.07	0	1
Policy (requirement)	163,169	.01	.09	0	1
Previous policies in state	163,169	5.09	9.87	0	74
NCCS, IRS:					
Nonprofits (logged)	163,169	20.62	141.34	0	13,630
Civic capacity (residual)	163,127	.02	.78	−3.35	4.50
Environmental nonprofits (logged)	163,169	.80	4.30	0	325
Environmental nonprofits (residual)	123,036	.00	.45	−1.01	4.36
Environmental nonprofits (%)	123,021	.05	.13	0	1
U.S. Census Bureau, ACS:					
Population	163,127	7.78	1.83	2.08	15.90
Population density	163,127	.00	.00	.00	.02
Median income (logged)	68,809	11.582	1.257	8.91	15.74
% white	68,809	76.52	10.88	31	95.1
Building permits	99,189	7.89	1.66	1.79	11.37
David Leip's election atlas:					
Voter share Democrats	163,169	.46	.12	.08	.86
Voter turnout	163,169	.59	.09	.25	1.12
U.S. Census of Governments:					
County budget (logged)	163,169	19.31	2.33	0	23.82
Municipal budget (logged)	163,169	16.444	2.309	0	21,441
Compustat:					
Companies	163,169	31.77	86.86	0	527
Average CSR	80,780	−.37	1.40	−7	12
IPEDS:					
Universities	163,169	13.92	30.24	0	172
Britannica:					
State capital	163,169	.00	.06	0	1
USGBC and ProPublica:					
USGBC state chapter	163,169	.74	.44	0	1

aggregated with policies of multiple governments to an entire CBSA (e.g., York et al. 2018). Focusing on the municipality allows testing fine-grained effects of administrative policies on construction activity in the relevant jurisdiction; a more aggregate level of analysis would only detect spatial clusters of policies and buildings within the jurisdiction of multiple (sometimes

dozens) independent municipal governments. Data are drawn from the LEED public policies database provided by the USGBC. In addition to recording the year in which a law or ordinance was passed, I distinguish between requirements and incentives:

Requirement.—*The City Council of Austin passed a resolution in June **2000** requiring that all future building projects be built in accordance with the standard of [LEED] Silver.*

Incentive.—*In Chicago, since **2011**, "projects striving for higher levels of LEED certification [than Silver] will receive their permits within 30 days and are eligible to receive a partial permit waiver up to $25,000."*

Civic capacity.—Civic capacity is measured using the number of local 501(c)(3) organizations, logged to account for skewness and standardized to facilitate the interpretation of the coefficients. The data come from nonprofits' Internal Revenue Service (IRS) 990 tax forms, assembled by the NCCS from 2002 to 2015. A raw count of all nonprofits registered in a place as a proxy for a city's civic capacity introduces some analytical limitations that require special accommodations. For one, the number of nonprofit organizations in an urban area is correlated with population numbers and density. I overcome this problem by following an econometric strategy described by Rao and Greve (2018) as a "control function approach." I used the residual of the count predicted in an ordinary least squares regression with size and density, Democratic voter share, voter turnout, and region, to identify the extent to which a city's nonprofit count deviates from what can be expected on the basis of its population, politics, and social capital.[6]

Another challenge is that nonprofits engage in different strategies and should therefore "not be treated as a single kind of thing" (Marwell et al. 2020, p. 1579; see Lichterman and Eliasoph 2014; Vargas 2016; Lichterman 2020). I thus consider the presence of environmental nonprofits in particular, in relation to the NTEE (National Taxonomy of Exempt Entities) classification scheme. Because of the high correlation between nonprofit density in general and environmental nonprofit density, I also include a measure of the share of environmental nonprofits in the total population. To make sure that the findings are robust to type of organization, I excluded organizations in specific subsectors, such as international aid, to no different

[6] I tested various configurations of this variable: logged counts with a population control, count per capita with and without population control, and the diversity of different types of nonprofits, as, according to Rao and Greve (2018, p. 9), a "diverse non-profit sector leaves the community with significant civic capacity, including experienced founders and workers, dense social connections, and trust of others." The results are robust with respect to these modeling choices, as I show in app. B.

effect. Finally, I performed several secondary analyses of how the presence of different types of organizations featured in existing studies affects the outcome (described in the discussion section and app. A). These findings are entirely robust, despite the inclusion of organizations that are unlikely to have a positive effect on construction practices or civic capacity, which suggests a conservative measure of civic capacity.

City controls (longitudinal).—A battery of time-variant controls at the city level account for alternative explanations for the place-based disparities in green-building certification. All models include a control for the logged population from the American Community Survey (ACS). Because civic action—including volunteering—is greater in denser areas (Musick and Wilson 2007), I include a density measure of population per square mile calculated from the 2010 national Census Gazetteer files. I use the average vote share from the Atlas of Presidential Elections for the democratic candidate in four presidential elections from 1996 to 2012 as a proxy for the political leaning of the local population. I also include traditional measures of social capital (Putnam 2000). These measures are not available on a yearly basis and are limited by the fact that they include the unweighted number of nonprofits as a component. I thus use the component of average voter share as a covariate in all models (Rupasingha, Goetz, and Freshwater 2006). The models are robust to the inclusion of the full, county-level measure of social capital.

City controls (cross-sectional).—A series of additional covariates are either only available at one point in time or time invariant. I discuss the motivation for including these variables in the robustness section. I also use budget data from the 2012 Census of Government to account for the fact that municipalities and counties with greater financial capacity have more leeway in building costs. I control for state capitals, as capital cities feature greater nonprofit activity and state-sponsored green buildings. I include demographic data from the ACS to account for qualitative differences in city population, including median income, percentage black, percentage college graduates, and employment rate. To control for cultural prosocial norms, I follow Marquis et al.'s (2007) proposition to devise a composite measure of average regional CSR, using MSCI's Environmental, Social and Governance (ESG) Ranking. MSCI evaluates publicly listed firms in terms of their positive and negative social and environmental performances. To consider the overall building activity, I control for the number of housing units authorized by building permits from the Census Permits Survey. I also control for the number of large corporations, as this enlarges the risk set of organizations that can register a LEED building. Because universities may have a similar effect, I also include a count of R1 universities in the metropolitan region, drawn from IPEDS.

State and region covariates.—To consider the potential influence of the USGBC on buildings and policies, I included the presence of a state

chapter as a potential source of social movement influence.[7] In supplementary analyses, I include covariates from the Correlates of State Policy Project to account for the ideological disposition of states and state governments (Jordan and Grossmann 2016) and state policy innovativeness (Boehmke and Skinner 2012). I draw on data that follow the coding protocol of the Dynamics of Collective Action project to ensure the robustness of my results to the presence of environmental protests for each year and state (Muñoz, Olzak, and Soule 2018). All models without fixed effects control for region, as defined by ICMA. The results of these state-level robustness checks are available on request. National and international influences on local adoption decisions are discussed in the appendix.

Methods

The presence of LEED buildings and policies by 2016 is modeled through a cross-sectional logistic regression (table 2). The timing of the first registrations and policies is modeled through an event history analysis of the first year of adoption of a LEED certification or public policy for the entire risk set from 1999 to 2016 (table 3). Because some cities had certifications before 2002, the first available year of nonprofit data, the independent variables are linearly imputed to prevent left censoring.

The number of registrations is estimated with Poisson models for panel data that include city-level fixed effects (tables 4 and 5). Fixed effects models have the benefit of ability to control for time-invariant unobservable factors, such as regional culture and history. To investigate the impact of LEED policies on the subsequent number of LEED registrations, I employ interrupted time-series analyses to identify differences between adopters and nonadopters (Bernal, Cummins, and Gasparrini 2017). To control for national trends, I include a continuous time variable or year fixed effects where feasible (table 6).

Because panel models analyze within-unit change, cities without LEED certifications are dropped from the longitudinal analysis. A Vuong test indicated that zero adoption is structural, suggesting that a zero-inflated negative binomial (ZINB) model provides the best fit for the count data

[7] I recorded the first year in which a state chapter of the USGBC was registered. I drew on two sources of data: the USGBC directory of members and the state chapter's tax filings. Most USGBC state chapters were easily identifiable, except for some that had changed their name (the Illinois Green Alliance) or where a single organization covers multiple states (the Cascadia Green Building Council). Using the ProPublica Nonprofit Explorer, I pulled up the IRS form 990 of tax exemption for each chapter and recorded the year of registration. In cases of a discrepancy between these two dates, I included the earliest date.

TABLE 2
Logistic Regression of Whether There Is a LEED Policy and at Least One LEED Building in a City in 2015

	Presence of LEED Policy Model 2.1	Presence of LEED Building Model 2.2
Civic capacity	.905***	.895***
	(.117)	(.036)
LEED policy		1.681***
		(.367)
Population	1.642***	1.881***
	(.107)	(.045)
Population density	.028	−.049+
	(.048)	(.027)
Voter share Democrats	.727***	.314***
	(.110)	(.042)
Voter turnout	.142	.190***
	(.119)	(.045)
Building permits	.180	.211**
	(.162)	(.068)
Budget: county	.050	.067**
	(.076)	(.026)
Budget: municipality	−.135*	.047+
	(.054)	(.027)
Universities	.009	−.045*
	(.058)	(.022)
Companies	−.088	−.136*
	(.145)	(.064)
State capital	.525	
	(.427)	
Constant	−7.598***	−1.793***
	(.331)	(.082)
Region fixed effects	Yes	Yes
Observations	10,510	10,468
Pseudo R^2	.38	.41
Akaike information criterion	1,586.72	8,290.24
df	15	15

Note.—State capital is dropped from model 2.2 because all state capitals had at least one LEED building registration by 2016. Numbers in parentheses are SEs.

+ $P < .10$.
* $P < .05$.
** $P < .01$.
*** $P < .001$.

($P < .001$). The assumption of a ZINB model, by contrast with a Poisson model, is that different processes generate zero and count values in the dependent variable. ZINB models remedy overdispersion and zero inflation due to structural nonadoption. In addition to examining structural nonadoption, these cross-sectional models enable explicit tests of model robustness to stable factors such as location and wealth.

RESULTS

Civic Capacity and Green Construction

Presence.—How does the presence of green building certifications differ between and within U.S. cities? I begin by showing a simple model that is suggestive of the importance of civic capacity for green construction in 2016. Figure 2 shows a very strong relationship between civic capacity and the official actions of a city to encourage or require green

TABLE 3
EVENT HISTORY MODEL PREDICTING A CITY'S HAZARD OF ADOPTING A LEED POLICY OR A LEED BUILDING, 2000–2016

	HAZARD OF BUILDING Model 3.1	HAZARD OF POLICY Model 3.2
Civic capacity	.643***	.556***
	(.026)	(.108)
LEED policy	.295**	
	(.108)	
Early adopting city		.455**
		(.169)
USGBC state chapter	.140**	.439*
	(.050)	(.218)
Buildings adopted in state in $t - 1$	.029***	
	(.008)	
Policies adopted in state in $t - 1$		.029
		(.056)
Population	1.474***	1.419***
	(.023)	(.100)
Population density	−.033^{+}	−.049
	(.017)	(.043)
Voter share Democrats	.143***	.618***
	(.022)	(.091)
Voter turnout	.199***	.108
	(.021)	(.082)
Universities	.002	.017
	(.013)	(.043)
Companies	.046*	.058
	(.020)	(.075)
State capital	−.123	.248
	(.174)	(.267)
Region fixed effects	Yes	Yes
Observations	149,208	174,315
Pseudo R^2	.11	.21
Akaike information criterion	58,502.49	41,10.32
df	15	15

NOTE.—Numbers in parentheses are SEs.
$^{+}$ $P < .10$.
* $P < .05$.
** $P < .01$.
*** $P < .001$.

TABLE 4
Poisson Model Predicting Number of New LEED Registrations including City Fixed Effects, 2002–16

	Model 4.1	Model 4.2	Model 4.3	Model 4.4
Civic capacity	.687***	.638***		.631***
	(.036)	(.037)		(.037)
Initiation × civic capacity		.144***		.139***
		(.018)		(.018)
Environmental nonprofits			.107***	
			(.018)	
Initiation × environmental nonprofits			.129***	
			(.011)	
Environmental nonprofits (%)				.091**
				(.034)
Initiation × environmental nonprofits (%)				.280***
				(.047)
Initiation stage	−1.482***	−1.654***	−1.720***	−1.604***
	(.019)	(.029)	(.023)	(.030)
LEED policy	.242***	.297***	.321***	.293***
	(.025)	(.026)	(.026)	(.026)
Buildings adopted in state in $t - 1$	.028***	.028***	.031***	.028***
	(.001)	(.001)	(.001)	(.001)
Population	3.059***	3.045***	4.065***	3.110***
	(.140)	(.140)	(.132)	(.141)
Population density	−.010***	−.010***	−.009***	−.010***
	(.001)	(.001)	(.001)	(.001)
Voter share Democrats	.195***	.198***	.148***	.197***
	(.023)	(.023)	(.023)	(.023)
Voter turnout	−.109***	−.115***	−.178***	−.117***
	(.006)	(.006)	(.005)	(.006)
City fixed effects	Yes	Yes	Yes	Yes
N	50,476	50,476	49,117	49,109
Akaike information criterion	1.0E+05	1.0E+05	1.0E+05	1.0E+05
df	8	9	9	11

Note.—Numbers in parentheses are SEs.
$^{+}$ $P < .10$.
* $P < .05$.
** $P < .01$.
*** $P < .001$.

construction.[8] This effect is highly significant, even when the city's size, liberalism, political participation, municipal budget, construction activity, companies, and region are controlled ($\beta = .91$, $P < .001$). By 2016, cities with higher civic capacity were three times as likely to have at least one LEED-certified building, net of the presence of an official LEED policy ($\beta = .90$,

[8] For ease of comparison, all coefficients other than for dummy variables are standardized with a mean of 0 and a standard deviation of 1. Independent variables are lagged by one year. All models report errors in parentheses and statistical significance as follows: $^{+}$ $P < .1$, * $P < .05$, ** $P < .01$, *** $P < .001$.

TABLE 5
Poisson Model Predicting Number of New LEED Registrations by Sector, 2002–16

	All Model 5.1	Nonprofit Model 5.2	Corporate Model 5.3	Government Model 5.4	Homes Model 5.5
Civic capacity	.649***	.791***	.485***	.457***	1.075***
	(.039)	(.151)	(.069)	(.105)	(.074)
Environmental nonprofits (%)	.105**	.107	.182**	−.028	−.147*
	(.032)	(.121)	(.056)	(.087)	(.069)
LEED policy	.409***	.382***	.437***	.433***	1.731***
	(.024)	(.069)	(.036)	(.062)	(.120)
Population	1.395***	−2.536***	.663**	−2.074***	.430+
	(.134)	(.528)	(.257)	(.474)	(.223)
Voter share Democrats	−.013***	−.010*	−.007***	−.008+	−.061***
	(.001)	(.004)	(.002)	(.004)	(.005)
Voter turnout	.920***	1.062***	.589***	.857***	1.657***
	(.022)	(.072)	(.037)	(.059)	(.051)
Year	−.095***	.039	−.039***	−.120***	−.102***
	(.006)	(.028)	(.011)	(.020)	(.011)
City fixed effects	Yes	Yes	Yes	Yes	Yes
N	49,109	14,995	32,968	21,900	9,356
Akaike information criterion	1.0E+05	13,120.82	39,684.73	19,178.23	49,723.55
df	8	8	8	8	8

Note.—Numbers in parentheses are SEs.
+ $P < .10$.
* $P < .05$.
** $P < .01$.
*** $P < .001$.

$P < .001$). On average and net of other differences, the number of nonprofits in cities with at least one LEED-certified building is an order of magnitude higher than in those that do not have one (3.6 to 58.4).

Timing.—The event history analysis reported in figure 3 shows that individual organizations in cities with more civic capacity could also adopt LEED certification ($\beta = .64$, $P < .001$) and LEED policies ($\beta = .56$, $P < .001$) sooner regardless of their politics and size. The average year of first adoption for cities in the highest quintile of civic capacity was 2005; those in the two lowest quintiles averaged 2009, well past the initiation stage.[9] Initially adopting cities included the usual suspects of Boston and Cambridge, Massachusetts; Chicago, Illinois; Los Angeles and San Francisco, California; Portland, Oregon; Seattle, Washington; and Washington, D.C., as

[9] The event history analysis shows that some cities are at very low risk of experiencing any certifications, often because they are too small. Cities that had not added any LEED-certified buildings by 2016 are excluded from the count models presented in tables 4–6, resulting in a sample of 3,630 places for which the number of buildings varied by year and no covariates were missing.

TABLE 6
Poisson Models of Interrupted Time Series of LEED Building Count with LEED Policy as Treatment, 2002–16

	Any Policy Model 6.1	Incentive Model 6.2	Requirement Model 6.3
Civic capacity	.535***	.541***	.527***
	(.040)	(.039)	(.040)
Public policy	.397***		
	(.025)		
Time from policy	.100***		
	(.002)		
Public policy × time from policy	−.031***		
	(.003)		
Incentive		.098**	
		(.032)	
Time from incentive		.092***	
		(.002)	
Incentive × time		.012*	
		(.005)	
Requirement			.402***
			(.026)
Time from requirement			.102***
			(.002)
Requirement × time			−.041***
			(.003)
Population	1.807***	1.820***	1.785***
	(.140)	(.141)	(.141)
Population density	−.010***	−.011***	−.009***
	(.001)	(.001)	(.001)
Nonprofits (% environmental)	.097**	.096**	.091**
	(.033)	(.033)	(.033)
Voter share Democrats	.877***	.910***	.869***
	(.022)	(.022)	(.022)
Voter turnout	−.114***	−.113***	−.114***
	(.006)	(.006)	(.006)
City fixed effects	Yes	Yes	Yes
N	45,586	45,586	45,586
Akaike information criterion	1.0E+05	1.0E+05	1.0E+05
df	9	9	9

Note.—Numbers in parentheses are SEs.
+ $P < .10$.
* $P < .05$.
** $P < .01$.
*** $P < .001$.

well as less obvious trailblazers such as Austin, Dallas, and Houston, Texas; Little Rock, Arkansas; Phoenix, Arizona; Pittsburgh, Pennsylvania; Raleigh, North Carolina; and Salem, Oregon.

Extent.—Table 4 shows panel models of the number of registrations for green-building certification in every given year. By including fixed effects to control for time-invariant city characteristics, I confirm that civic capacity

is positively associated with the number of registrations. Model 4.1 provides strong support for hypothesis 1 ($\beta = .69$, $P < .001$). A full standard deviation increase in civic capacity is associated with twice the number of LEED registrations in the subsequent year. Controlling for a city's size and political leanings, an increase in three organizations from one year to another increases the likelihood of at least one registration each year, by a factor of 6.5 ($P < .001$).

Figure 4 shows the number of LEED-certified buildings by 2016 for cities with populations above 100,000, plotted against civic capacity. Unsurprisingly, many of the cities that had amassed the most buildings by 2016 were also among the earlier adopters, including Washington, D.C. (2,324 registrations); New York, New York (1,663 registrations); and Dallas, Texas (1,552 registrations). Cities that stood out early in terms of their buildings per capita were often college towns, including Cambridge, Massachusetts; Fort Collins, Colorado; New Haven, Connecticut; Pittsburgh, Pennsylvania; Seattle, Washington; and Syracuse, New York. Although many leading cities are Democratic leaning, political preferences are not deterministic: several cities in relatively Republican-leaning counties are among the leaders. However, all these cities registered above-average civic capacity. Only much later did

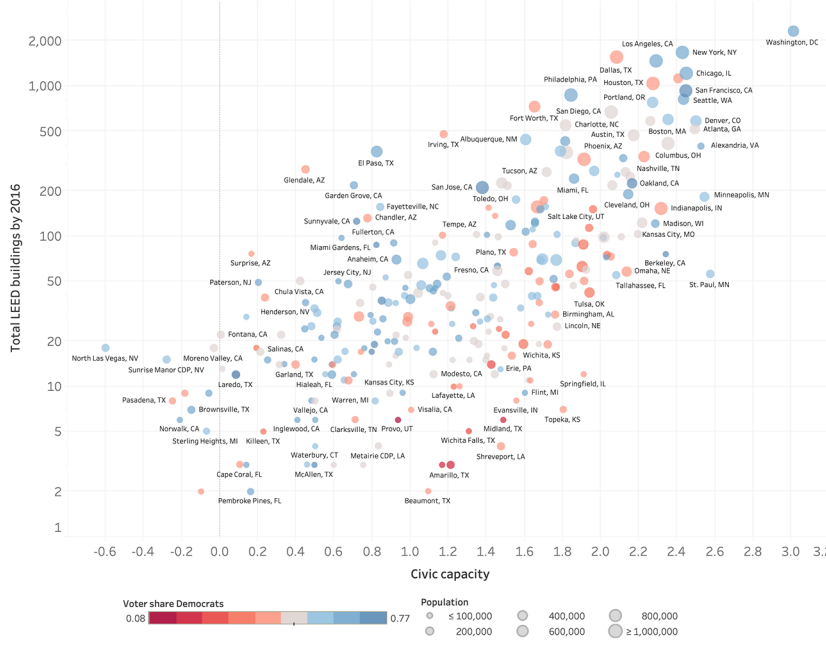

FIG. 4.—Scatter plot of U.S. places above population 100,000 in terms of civic capacity and LEED buildings by 2016.

places with large-scale prefabricated and luxury housing developments, such as Irving and McKinney, Texas, and Glendale and Chandler, Arizona, as well as the corporate campuses of Apple and Google in Sunnyvale, California, propel cities with lower civic capacity to the per capita top. Even sizable cities with lower levels of civic capacity registered a modest number of registrations, such as Jacksonville, Forida; Mesa, Arizona; Las Vegas, Nevada; Philadelphia, Pennsylvania; and San Jose, California.

Initiation of Distributed Adoption

Catalysts.—Which organizations contributed to the emergence of green construction in U.S. cities? The leftmost panel of figure 1 provides some insight on the early adopters. Both nonprofits and municipal governments played an active role in legitimating LEED certification. Nonprofit entities are overrepresented among certifications in the early period. Environmental leaders, such as the California Academy of Sciences and the National Research Defense Council, were among the first adopters in the San Francisco Bay Area, together with life science laboratories, libraries, and philanthropic foundations. The Hewlett Foundation, for instance, spearheaded LEED to be "consistent with the environmental grant portfolio at the time," as a former board member recalled. In the Midwest, the Chicago Center for Green Technology was an early experiment in green technology and served as a model for other project owners. Another forerunner was Access Living, a disability organization whose 2007 headquarters showcases barrier-free architecture and art about the disability rights movement. In other parts of the country, the first LEED building in Boulder, Colorado, was the nonprofit Boulder Community Foothills Hospital, and the Botanical Research Center of Texas was one of the first platinum-certified buildings in Fort Worth, Texas. In several city regions, public project owners played a leading role, such as the public libraries of Los Angeles and San Mateo, California; the police headquarters in Dallas, Texas; and the State Department of Environment in Albany, New York. As one LEED executive told me, government and nonprofit entities were early adopters because green buildings reflected their "aspirational goals and social missions." A comparison of the predictors of LEED registrations by sector in table 5 shows that nonprofit organizations were the only owners whose number of new registrations has declined over time; most of the later growth is attributable to homes and corporations.

Initiation through civic capacity.—Hypothesis 2 suggests that the influence of civic capacity may be stronger at the onset, when the certification scheme is new. As presented in model 4.2, cities had a lower probability of adopting LEED and registered fewer LEED building certifications during the period of early adoption. The number of LEED-certified buildings before

2006 is dramatically lower than that after 2006. Civic capacity matters more to early adoption than to late adoption, however. These results are not sensitive to the cutoff; in fact, a continuous interaction between time and civic capacity is also significant (see app. B for model robustness). Although this is consistent with earlier work on two-stage diffusion, I find that place-based characteristics such as size, political attitudes, and civic capacity continue to matter for adoption, even after the idea of green-building certification became taken for granted. This suggests that civic capacity is not only a trigger for early adoption: the active influence of civic capacity persists once the innovative practice has become institutionalized.

Initiation through environmental advocacy.—Could these effects be due to the advocacy activities of environmental associations rather than to civic capacity broadly conceived? Model 4.3 shows that LEED registrations are also associated with environmental nonprofits, and at an increased rate in the initial period ($\beta_{\text{combined}} = .24$, $P < .001$). The share of environmental nonprofits in the local nonprofit sector also adds to the civic capacity effect in the initiation stage ($\beta_{\text{combined}} = .36$, $P < .001$). As model 4.4 shows, the coefficient of general civic capacity is virtually undiminished upon inclusion of the share of environmental nonprofits in the sector ($\beta_{\text{combined}} = .77$, $P < .001$). This suggests that civic capacity at large complements the direct influence of environmental advocacy organizations.

Scaling through Administrative Adoption

Policy effect.—How did public policy factor into the scaling up of green construction? Several cities that went from early adopters with modest numbers of buildings to national role models offer hints. Cincinnati, Ohio, punches well above its weight with 1.7 building registrations per 1,000 inhabitants (50% more than runner-up Washington, D.C.). In 2006, Cincinnati was home to a handful of LEED projects including the University of Cincinnati's Student Life Center, a building at the Cincinnati Zoo and Botanical Garden, and the corporate headquarters of renewable energy supplier Melink. That year, the city council amended a tax abatement program to incentivize green construction, offering property tax exemptions on parts of the assessed value of LEED-certified buildings. A 2018 USGBC report cites a local news report, according to which, "because of the tax abatement, nearly every new home in Cincinnati is LEED-certified and builders have become quite familiar with how to do it cost-effectively" (USGBC 2018, p. 1). Dallas, Texas, stands out as another city with an unexpectedly high LEED building count, in part because the housing nonprofit Habitat for Humanity certifies most of its projects, single-handedly accounting for 29% of registrations by 2016. In an interview, the director of technical policy at the USGBC suggested the early 2003 requirement for public buildings to

be certified may have played a role in positioning Dallas as a conservative green city. He also acknowledged the significant corporate presence in Dallas (like neighboring Houston, which also ranks highly and adopted a policy in 2004) and the fact that "the mayor's office is able to actually celebrate good things when they happen, creating a positive spin on development even if the city didn't make them happen." Aggressive public policy also played an important role in Washington, D.C. The city's lead sustainability planner explained that "the number of LEED buildings is a general indicator of the impact of the built environment on the climate. . . . It's almost understood that if your project goes before the zoning committee it's going to be minimum LEED Silver. We use that as a benchmark." Still a modest adopter in 2006, by 2016 Washington, D.C., not only had the highest civic capacity in the country but also had the largest total number of LEED-certified buildings. This suggests that, in cities with high civic capacity, public policy plays a leading role in encouraging green construction.

These cases reflect a general pattern. I systematically analyze municipal policies that encourage or require green building certifications in U.S. cities with respect to their effects on private certification behavior. Table 6 presents the results of an interrupted time-series regression (Bernal et al. 2017). Model 6.1 shows that the adoption of a policy leads to a level change, which suggests an immediate policy effect on certification activity in the following year ($\beta = .40$, $P < .001$).[10] Although the level change increases the overall number of certifications, the time trend falls slightly after a policy has been issued, as indicated by a slightly negative slope change ($\beta_{\text{before}} = .10$, $\beta_{\text{after}} = .07$, $P < .001$). The findings are similar for coercive and incentivizing policies, which implies that the legitimation of the certification scheme itself may be responsible for the level change. Whereas incentives accelerate subsequent adoption (model 6.2), requirements do not (model 6.3). The coefficient for civic capacity is not diminished upon inclusion of the policy effects. As the event history model 3.2 shows, cities with higher civic capacity, all else being equal, adopt public LEED policies significantly sooner ($\beta = .56$, $P < .001$), as hypothesis 3b suggests.

Policy follows individual initiative.—Table 6 also suggests that the adoption of green-building certifications is not exogenous: cities without policies saw less certification activity to begin with. Model 3.2 confirms that cities whose governments eventually issue policy to ensure high environmental standards in construction also have early adopting organizations ($\beta = .46$, $P < .001$). Overall, I found that individual certification activity preceded a public decree by an average of two years: a Wald test shows that the average

[10] For nonadopters, the cutoff year is 2007, the median year in which policies were adopted.

year of the construction of the first LEED-certified building ($\mu = 2005$) is significantly earlier than the first year of a LEED policy ($\mu = 2007$, $P < .001$). Consistent with hypothesis 3c, this policy loop is another important indication of the collaborative dynamics of distributed adoption.

Propensity for policy adoption.—Whether a city eventually adopts a policy may be due to differences in size, political orientation, civic capacity, and geography rather than prior adoption. I employ propensity score matching to compare the impact of policies among cities with an equal propensity to adopt that policy on the basis of all factors except prior LEED certifications. The average treatment effect of adopting a policy of around 18 buildings per year in the unmatched sample decreases to around 10 buildings per year in the matched sample ($P < .001$). Even after matching, there is a significant difference in the number of adoptions of LEED-certified buildings in the year before a policy between cities with a policy (seven buildings) and cities without one (three buildings). The estimated treatment effect among cities with a low propensity for adopting a policy in the first place is insignificant. While public policy has an immediate effect on subsequent adoption, cities without prior individual adoption do not tend to put policies into place, and policies in cities without prior certification activity produce a smaller policy effect. Although public policy matters for the uptake of certifications within a city, evidence suggests that civic capacity is the fundamental cause and catalyst of both administrative and distributed action.

Robustness to Alternative Explanations

Structural nonadopters.—Panel data allow unobservable time-invariant characteristics of cities, such as local climate, customs, and resource endowments, to be controlled using fixed effects. However, it is possible that time-varying factors confound the estimates. I therefore employ a series of secondary models to test alternative explanations for variation in green-building certifications between U.S. cities. Table 7 reports several of these robustness tests, the results of which are consistent with the longitudinal analyses.

Demographic factors.—The population of cities with an expansive civic life may also be more prosperous and more highly educated, so I controlled for demographic factors. For the 270 metropolitan regions where ACS data were readily available, median income, the share of the population with a high school/college degree, median age, and racial composition and segregation did not alter the effect between civic capacity and LEED certifications. The absence of LEED-certified buildings is less likely in cities with higher median income (model 7.2).

Construction activity.—A related explanation for the findings is that cities with higher civic capacity also experience more construction activity,

TABLE 7
ZINB Models of Number and Absence of Buildings with Controls, 2002–16

	Model 7.1	Model 7.2	Model 7.3	Model 7.4	Model 7.5	Model 7.6	Model 7.7
Number of buildings:							
Civic capacity	.577***	.597***	.622***	.575***	.573***	.585***	.656***
	(.082)	(.089)	(.089)	(.082)	(.082)	(.082)	(.098)
Policy dummy	.503***	.500***	.462***	.502***	.498***	.495***	.459***
	(.123)	(.134)	(.128)	(.123)	(.121)	(.117)	(.134)
Median income		−.139**					
		(.043)					
Share white		−.013					
		(.072)					
Permits			.050				
			(.057)				
USGBC chapter				.215*			
				(.088)			
County budget					.014		
					(.044)		
Municipal budget					−.148+		
					(.075)		
Companies						−.151***	
						(.043)	
Universities						−.284+	
						(.149)	
Average CSR							.123
							(.076)
Constant	−3.131***	−2.573***	−3.202***	−3.205***	−3.113***	−2.846***	−3.438***
	(.257)	(.248)	(.286)	(.251)	(.251)	(.259)	(.291)
Structural absence of buildings:							
Civic capacity	−.587***	−.678***	−.635***	−.589***	−.595***	−.571***	−.583***
	(.078)	(.086)	(.085)	(.077)	(.078)	(.078)	(.103)
Policy dummy	−.593*	−.476	−.583*	−.593*	−.581*	−.622*	−.562+
	(.259)	(.300)	(.285)	(.259)	(.253)	(.268)	(.323)

Median income		−.203**					
		(.066)					
Share white		−.128					
		(.086)					
Permits			−.095				
			(.069)				
USGBC chapter				.076			
				(.163)			
County budget					−.162***		
					(.043)		
Municipal budget					−.267***		
					(.079)		
Companies						−.207*	
						(.088)	
Universities						−.553***	
						(.143)	
Average CSR							.157+
							(.082)
Constant	3.595***	2.677***	3.470***	3.515***	3.824***	3.918***	3.220***
	(.272)	(.294)	(.318)	(.277)	(.336)	(.281)	(.346)
ln(α)	.919***	.878***	.871***	.917***	.776***	.905***	.780***
	(.043)	(.049)	(.047)	(.043)	(.052)	(.044)	(.056)
City controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	151,467	68,787	99,163	151,467	151,467	151,467	75,857
Akaike information criterion	94,810.06	69,737.57	82,330.25	94,794.28	94,670.50	94,645.57	64,186.44
df	23	23	24	24	25	25	23

NOTE.—Numbers in parentheses are SEs.

+ $P < .10$.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

due to wealth or other confounding factors, and therefore simply have a greater possibility of having LEED-certified construction projects. However, the number of building permits (both in total and only those for very large buildings) did not alter the main effects (model 7.3). Although the entire risk set of buildings that could potentially be certified in any given year is unobservable, the building count results are consistent with those derived from estimating the number of buildings per capita.

Municipal state capacity.—Another concern about private action for the social good is that it may occur in response to government failure (Clemens and Powell 1998). I therefore estimate whether urban regions whose local governments have lower budgets are associated with increased certification activity. This is not the case, as average municipal and county budgets are associated with a higher LEED count but are not associated with the presence of LEED in general (model 7.4). I also test whether the average number of municipal services reported in an ICMA survey on the mode of municipal service delivery compromises the association between civic capacity and certifications but find no effect ($P > .05$).

Geographic diffusion.—A drawback of using models with city fixed effects is that they absorb spatial dynamics, such as proximity to other adopters. Spatial differences are likely to occur, however, given the unequal distribution of environmental risks between cities and potential changes in the urgency with which these risks are perceived over time. Region dummies in the cross-sectional models show that cities on the U.S. West Coast tend to have the lowest probability of structural nonadoption, but the average count does not systematically differ by region. Conventional peer diffusion proxies, such as the number of buildings in the same CBSA or state, are significant but do not attenuate the civic capacity effect (see tables 3 and 4 and app. C with respect to political and normative spillovers). Spatial autoregressive models for panel data (LeSage and Pace 2009) also suggest spillover between cities, such that cities that are located near those with many LEED certifications are themselves prone to adopting green-building certifications. Finally, I test the influence of a USGBC state chapter as a source of localized social movement pressures and identify a positive association with the building count. Finally, although time controls account for global contexts, appendix C also accounts for influence through city memberships in ICLEI—Local Governments for Sustainability, an international association furthering the advancement of local sustainability. The hypothesized effects are robust to all five checks.

Urban regimes.—Cities with strong growth coalitions, college towns, and state capitals are subject to governance dynamics that may be obscured by city fixed effects and that would separate these cities from others (Molotch 1976; Stone 1993; Mossberger and Stoker 2001). College towns further tend to have greater civic capacity, which may confound the civic capacity effect.

Model 7.6 suggests that this is not the case. Appendix D confirms that these special cases do not explain the civic capacity effect.

Cultural context.—Civic capacity may simply reflect a favorable governance context, akin to a general political opportunity structure, which encourages environmental action among individual actors (McAdam 2005). These effects could be driven by a general cultural propensity to live up to high organizational standards of social responsibility. I use the average rate of CSR within a community as an indicator for cultural norms (Marquis et al. 2007). There is a small, negative association between the number of companies and the number of LEED buildings in a city (model 7.6). City regions that have greater average CSR scores do not show a greater likelihood or higher numbers of green building certifications (model 7.7).

Autocorrelation.—Because professional know-how and infrastructure for LEED certification may accumulate within a community, the count of new certifications in t_1 may be a direct consequence of new certifications in t_0. The inclusion of certifications that were issued during earlier periods shows that lagged adoption has a statistically significant effect, but this does not change the results. AR(1) models for autocorrelation yield the same results. The quality of building certification increases with the number of previous registrations, as documented in appendix E.

DISCUSSION

Mechanisms of Civic Capacity

These analyses show that the timing and presence of green-building certification in U.S. cities is enabled by the population's ability to recognize and organize ostensible solutions for social problems. The robust relationship between the adoption of green construction and organizational aspects of civic capacity—net of established structural aspects such as interpersonal trust, corporate responsibility, or civic skills—is consistent with the growing evidence that a community's organizations influence important urban outcomes (Marwell 2004, 2007; de Graauw et al. 2013; Pacewicz 2015; Vargas 2016; Sharkey et al. 2017; Clifford 2018; Goldstein 2018; Schneiberg 2021). The positive effect of civic capacity on the initiation and scaling of green building practices and policies is robust and persistent, which raises the question of the mechanisms through which civic capacity operates.

Myriad causal pathways may contribute to the effect. Sociological work on urban governance suggests that organizational mechanisms largely fall into two categories (Marwell and McQuarrie 2013; Pacewicz 2015; Marwell et al. 2020). First, locally focused nonprofits influence communities by forging relationships among their members. Established pathways related to such *social integration* include the creation of community cohesion (Sampson 2012; Sharkey 2018), social capital (Putnam 2000; Klinenberg 2015), and cultural

norms (Marquis et al. 2007; Rao and Greve 2018). Second, nonprofits with citywide or broader geographic reach influence communities by partnering with established social institutions, such as political and market institutions. Established pathways related to such *systemic integration* include the enabling of social movement advocacy (Sampson et al. 2005; Amenta et al. 2010; Schneiberg and Lounsbury 2017), civic skills (Verba et al. 1995), and philanthropic action (Galaskiewicz 1997). Although any single organization can combine multiple approaches to civic action through scene switching (Lichterman and Eliasoph 2014), socially integrating organizations tend to be smaller, less professional, and more reliant on individual contributions; systemically integrating organizations are larger, more professional nonprofits that tend to have institutional revenue sources.[11] The supplementary models presented in appendix A show that the relative impact of these two types of nonprofits is similar, which suggests that both social and systemic strategies add to the influence of civic capacity.

That the effect of civic capacity in general outweighs the more immediate effect of environmental nonprofits on green construction deserves special attention.[12] There is no doubt that progressive environmental advocacy plays a role in legitimating and advocating for urban greening. In addition to setting the agenda and legitimizing certain environmental practices in the ways that national associations such as the National Research Defense Council and the Green Building Council have, local associations may act as trailblazers and role models for other urban dwellers; they likely proselytize proofs of concept from one city to others in ways that deserve further attention. In the context of a highly capitalized industry, however, neither dedicated environmental advocacy organizations nor progressive associations alone are sufficient to bring about widespread change.

So long as empirical research is limited to modeling civic capacity as the presence, density, or composition of nonprofit organizations instead of

[11] These empirical approximations are based on descriptive statistics of existing studies of the role of nonprofits in the governance process, notably the summary statistics of patronage and partner organizations in Marwell et al. (2020). Brandtner and Laryea (2022) offer further disambiguation based on organizational-level data characterizing nonprofits' interaction with their urban environment. These simplifications are subject to further validation but would allow for tests of theoretical claims developed in single cities, such as the disparate effects of patronage and partnership on governance, on the national scale.

[12] As discussed above, environmental nonprofits have a similarly statistically significant effect on green buildings, but the effect size is smaller. The same is true for other subsectors: organizations that engage in community improvement and capacity building (category S); specifically organizations that engage in economic development such as community development corporations (category S30–31); and philanthropy, voluntarism, and grant-making foundations including community foundations (category T). The findings are consistent for all these groups, suggesting that no individual organizational form or organizational strategy alone can explain the effect.

drawing on direct data showing what nonprofits do and where they do it, distinguishing between channels remains an open challenge (see Lichterman and Eliasoph [2014] and Lichterman [2020] for a critique). The measure of civic capacity goes beyond organizations that directly engage in climate change mitigation or are embedded in the local governance network, so its effect size may be underestimated. Moreover, organizations that are not nonprofits—such as public libraries or courthouses in the present case—may also engage in civic action. By taking a comparative approach to understanding place-based differences in the ability to do engage in such civic action, this study favors generalizability over the nuance of studies focused on the governance of one or a few cities. Future research intended to disentangle organizational contributions to the urban environment could adopt systematic comparisons of sets of organizations in different places using multisite survey research (e.g., through a systematic comparison of organizational-level studies of local nonprofit sectors, such as MacIndoe and Barman [2013] and Powell et al. [2016]). Despite its limited ability to speak to the relative importance of different mechanisms, this study offers robust evidence that a series of alternative specifications of civic capacity predicts differences among city-level outcomes.

Catalyzing Distributed Adoption of Urban Innovations

Taking into consideration both exercises of legal authority on the part of city administrations and distributed adoption among a city's organizational citizens paints a fuller picture of practice diffusion within and between cities than a binary focus on the adoption of city laws and ordinances. My analysis suggests that civic capacity plays multiple roles in the adoption of administrative and distributed innovation: nonprofits got the ball rolling during the initiation phase, when green construction was still new and the payoffs were uncertain. Early adoption by nonprofits later inspired the policies of local governments, the primary role of which was to make the practice attractive to or compulsory for laggard organizations. By thus activating corporate adoption, nonprofits also contributed to scaling up of practices, a finding that is consistent with research on the emergence of new industries (Bartley 2007; McInerney 2014). In more general terms, nonprofits are catalysts of the administrative and distributed adoption of urban innovations (Padgett and Powell 2012; Powell, Packalen, and Whittington 2012).

Figure 5 sketches out a general model of administrative and distributed adoption that involves ideal typical adoption behavior of (*a*) a central authority and (*b*) decentralized adopters over time. The left panel (T_1) shows the relationship between potential adopters during the initiation stage, whereas the right panel (T_2) shows the scaling phase of the adoption of

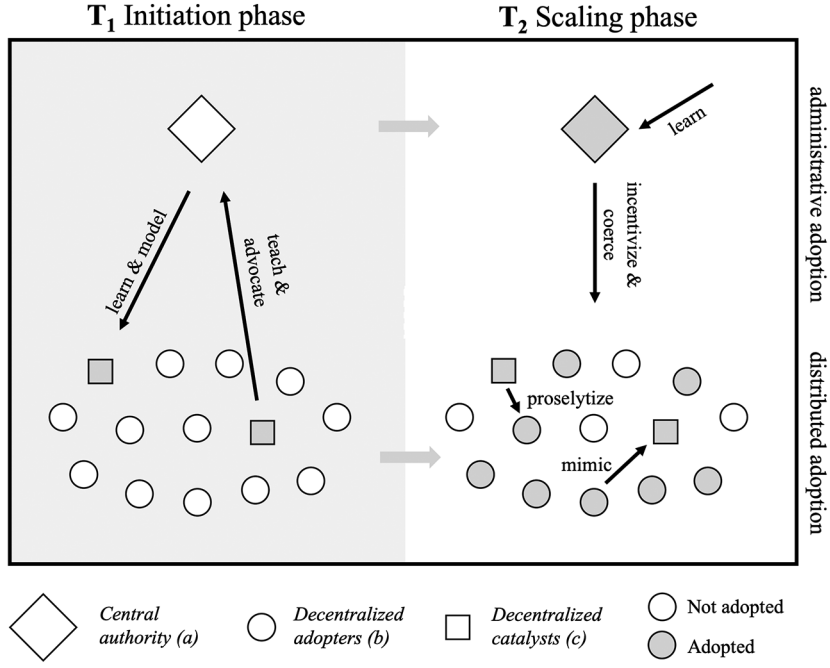

FIG. 5.—General model of administrative and distributed dynamics during the initiation and scaling phases of adoption of an organizational practice. For the diffusion of urban innovation, city administrations are the central authority, a city's organizations are decentralized adopters, and nonprofit organizations are catalysts; arrows indicate processes that contribute to practice diffusion within and between cities. Theories of distributed adoption emphasize processes of proselytization and mimicry, while theories of administrative adoption emphasize learning among entities as well as trickle-down effects through incentives and coercion. Combining the two types emphasizes processes that connect central authority to catalysts (learning from and modeling after) and vice versa (teaching and advocating).

innovation. Joining the two frameworks emphasizes (*c*) catalysts among the decentralized adopters who initiate a practice and then influence central authority, as well as other potential adopters in later stages of the diffusion process.

Specific attention to the temporal sequence of diffusion illuminates how early adopters can form connective tissue between a city and its administration. In addition to proselytizing what they have learned to peer organizations, such catalysts pass on information about and advocate for an innovation vis-à-vis a central authority. Central authorities in turn can learn from and model policies after the actions of catalysts. Catalysts indirectly shape later adoption through the incentives and coercion of central authorities. In this study, the catalysts are early adopting nonprofits and

public agencies, the central authorities are local governments, and the decentralized adopters are other organizations located in the city. In other settings, other organizations may fill these roles. In the conclusion, I discuss how this model and its application can contribute to institutional theories of environmental change, the role of civic capacity as a catalyst of diffusion within and between cities, and the role of organizations and governance in urban innovation.

IMPLICATIONS

Institutional Conditions of Disparities in Local Climate Action

This article responds to urgent calls in environmental sociology to develop an empirical understanding of how institutions shape the responses of firms, states, and individuals to a changing natural environment (Pellow and Nyseth Brehm 2013; Hironaka 2014; Jerolmack and Walker 2018; Dietz, Shwom, and Whitley 2020; Klinenberg et al. 2020). Going beyond the dominant view that economic production and environmental advocacy shape ecological modernization (Spaargaren and Mol 1992; Fisher and Freudenburg 2001), I find that geographic disparities in carbon emission mitigation follow organizational lines of distinction among cities. This emphasis on organizations and institutions offers a mesolevel explanation for variation in climate action and inaction (Shwom 2009; Bulkeley 2013). This theoretical framework resonates with extant institutional accounts of environmental changes, which hold that emergent cultural frameworks socially construct the awareness of environmental problems and legitimize ecological policies throughout countries (Frank et al. 2000; Schofer and Hironaka 2005; Hironaka 2014). In doing so, I extend traditional institutional work in environmental sociology in two important ways.

First, I reveal significant geographic variation within countries that share similar exposure to institutional pressures. Although cities are frequently disregarded in institutional studies in favor of organizations and nation-states, they nevertheless contribute to climate change mitigation in important ways, for instance, by setting ambitious goals for carbon neutrality, launching resilience programs, and promoting green building (Portney 2003; Vasi 2007; Bulkeley 2013; Ryan 2015; Klinenberg 2016). Although the long-term effectiveness of decentralized approaches to climate change policy is pending evaluation, polycentric approaches have been lauded for fostering experimentation and increasing social interactions regarding climate change, which can build social awareness (Betsill and Bulkeley 2007; Hoffmann 2011; Castán Broto and Bulkeley 2013; Cole 2015). This study is among the first to provide comparative, national, and contemporary evidence for the institutional dynamics of climate change mitigation in American cities.

Second, this study transcends institutional theorists' focus on symbolic commitments, such as voluntary reporting or support for a treaty (for an exception, see Grant, Jorgenson, and Longhofer 2020). The question of varied implementation of environmental policies is a pressing sociological concern, in part because urban sustainability goes hand in hand with social inequality. That is, failure to adapt to or prevent environmental degradation exposes marginalized communities to environmental hazards and decreases their long-term capacity, whether to retreat from rising sea levels or keep schools running after environmental disasters (Wachsmuth, Cohen, and Angelo 2016; Frickel and Elliott 2018). Green construction is one in a suite of local responses to climate change, and it has immediate effects on urban dwellers' quality of life. This is not to deny the potentially severe unintended consequences of green construction, for example, by exacerbating gentrification (Gould and Lewis 2016). It would be consistent with the findings of this study, however, if cities that are early adopters of green construction also recognized and remedied these unintended effects the soonest.

These findings buttress the view that, to improve community resilience in the Anthropocene, investments in social infrastructure in cities that are starved for civic capacity are preferred expensive physical infrastructure (Klinenberg 2016; Klinenberg et al. 2020; Hoffman and Jennings 2021). Beyond helping communities endure extreme weather events, civic capacity can help community members bring ideas to the table, bring forward grievances, and implement timely solutions. The general association between civic capacity and city climate action also implies spillovers into other policy areas. For instance, investing in educational and arts organizations can indirectly increase the population's capacity to problematize, organize, and advocate for resilience (Klinenberg 2018). Investigating further when and how nonprofit organizations and other aspects of a city's social infrastructure produce civic capacity for tackling climate change is an important venue for future research. Beyond environmental issues, this study has broader implications for urban and organizational sociology.

Civic Capacity and Diffusion within and between Cities

Identifying the ways that civic capacity enables both administrative and distributed adoption sheds light on the intertwining of organizations and the state in cities. Previous work on organizational communities has primarily focused on isomorphic pressures that urban environments exert on private-sector firms, portraying corporations as leaders of social innovation spurred on by social movements (Marquis et al. 2007; Marquis and Battilana 2009; Kwon, Heflin, and Ruef 2013). This important research ignores or downplays the role of the public sector, in part because it is conducted in contexts where the private sector dominates local development (e.g., Powell

et al. 2005; Greve and Rao 2012). Tracing a novel practice over two decades reveals shifts in the locus of innovation between sectors (Powell et al. 1996; Padgett and Powell 2012; Storper et al. 2015). While companies dominate a bird's-eye view of who has adopted green construction, geographic disparities originate in civil society. Nonprofits are early adopters of LEED registrations, and legitimating municipal policies are a consequence of this. Drawing on urban sociology, scholars of organizational communities should thus seek to understand cities as intertwined collectives of various types of organizations and to examine regional outcomes as a function of organizational and political processes.

Civic capacity persistently shapes such processes, but its influence varies dynamically over time. Tracing green construction before and after the establishment of a municipal policy underscores the particular importance of civic capacity before the adoption of an official policy. This primacy effect is owing to the establishment of clear proofs of concept by early adopters rather than anticipatory obedience to regulatory threats or the declining efficacy of social movement advocates (see Soule and King 2006; Sine and Lee 2009). Values-driven organizations are often early adopters of innovative practices instead of followers of trends present in the for-profit sector in a range of settings, from workplace policies to online transparency (Hwang and Powell 2009; Powell, Horvath, and Brandtner 2016). To be sure, public policies that regulate production and consumption in the marketplace may accelerate social change—as building codes did in the context of green construction. However, these policies typically follow voluntary, individual adoption, presumably even more so when a practice requires high initial investment, when it polarizes potential adopters, or when it threatens the status quo. Future research could define the conditions under which public agencies, nonprofits, radical social movements, or the market act as catalysts of innovations.

Observing changes over time offers a more complete picture of the policy process than that provided previously by scholars studying responsiveness to political mobilization or analysts studying policy impact (Schumaker 1975; Amenta et al. 2010). Here, the rare inclusion of negative cases, such as cities in which no policy is adopted, allowed a distinction to be drawn between prepolicy initiation and postpolicy scaling (McAdam and Boudet 2012). Studies of policy diffusion have paid little attention to how the stages that follow a policy adoption interact with those that lead up to it (Soule and King 2006; Naumovska, Gaba, and Greve 2021). Much administrative adoption, including that of treaties and formal resolutions, is motivated by the reputational concerns of competing city governments and mimicking the behavior of others. City administrators justify these ordinances in terms of the changes in awareness and behavior that they may prompt on the part of individual citizens and organizations in the community. For instance, a

municipal bill of rights is a case of an administrative initiative developed in concert with local civil society (Vasi and Strang 2009). The spill-over effect of administrative behavior on private actors and the degree to which it is endogenous to preexisting beliefs and behaviors in a population are underexplored as of yet.

Finally, the general model of administrative and distributed adoption depicted in figure 5 is not unique to the urban context; it can be generalized to all sorts of diffusion processes among organizations. This claim of generalizability demands clarity regarding the (testable) scope conditions of the argument. First, the model only applies to behaviors that both private and public actors have leeway to adopt. Some examples include efforts to increase workplace diversity, support worker rights, and improve openness and transparency. Second, these behaviors should have broad legitimacy in the wider social context of individual organizations. If private actors face institutional environments with divergent goals or if some are shielded from concerns regarding external legitimacy, they may be discouraged from doing what is locally seen as legitimate. Likewise, if there is dissent within organizational communities due to conflicts of interest or because multiple solutions are available for a single problem, the same collaborative dynamic may not appear. Finally, the model requires that adoption involve multiple levels of aggregation. Although administrative and distributed adoption are on clear display in cities, this dual structure is not unique to them. Organizations and states are themselves simultaneously actors and sites of collective action (King et al. 2010; Bromley and Sharkey 2017). Future research should test this condition with respect to organizations' official policies and intraorganizational collective action, for instance, regarding whether firm policies are adopted in response to exemplary employees within a firm.

Organizations, Governance, and Urban Innovation

Finally, this article contributes to an organizational view of cities that McQuarrie and Marwell (2009) declared to be missing from urban sociology. I conceptualized the adoption of novel practices and policies—often seen as the domain of entrepreneurial city administrations—as a collective process that incorporates multiple actors. This insight complements recent sociological work on urban governance, which has established that development and poverty alleviation in cities such as New York and Boston depend on formal and informal organizational dynamics (Marwell et al. 2020; Levine 2021). This work illuminates the ecological dynamics of urban governance in neighborhoods and cities and emphasizes the important role of nonprofit organizations that act as representatives, patrons, and partners. Governance scholars have also drawn on the insights of ethnographic studies to

examine "the effects of these conditions and changes on people" across the United States (Marwell and Morrissey 2020, p. 246).

Analyzing urban governance quantitatively and on an intercity scale, my study illuminates the consequences of the actions of nonprofit organizations with respect to an important outcome that urban governance scholars have hitherto neglected: the adoption of novel building practices to address social and environmental problems. Using insights developed in a handful of cities to over 11,000 places, I find that civic capacity is a fundamental catalyst of the distributed adoption of urban innovations.

This finding provides concrete, comparative evidence of the wide-reaching consequences of what Marwell et al. (2020, p. 1596) call "nonprofit flexibility" and responds to their challenge that "the role nonprofits play in urban settings should be treated as an empirical question, to be won as a social fact." My study confirms the profound influence that nonprofit organizations have on urban governance. The effect of civic capacity is stronger earlier in the diffusion process, underscoring time as a central dimension in the general model depicted in figure 5. This suggests that the urban governance dimensions of scale, flexibility, and fragmentation may be sensitive to temporal sequencing, which moderates the ways in which nonprofits influence decisions about the pursuit of collective outcomes. The methodological innovation of directly comparing counts, densities, and residuals of organizations across subsectors may lay the way for future work to develop more carefully specified theories of how differences in nonprofit flexibility and nonprofit strategy affect urban governance.

Concerning which cities adopt urban innovations, the new model of administrative and distributed adoption differs from established legal-political understandings. By contrast with accounts of city administrations as "empowered" experimenters who are held back by restrictive legal and political environments (Peterson 1981; Frug and Barron 2013; Schragger 2016), the governance framework centers the role that private experimentation and "soft law" play in shaping expressions of sovereignty.[13] Unlike legally binding provisions by urban authorities, the "rule of nonlaw" may not cause widespread enrollment in the way that city ordinances and state law do. However, it may encourage enthusiasts to establish proofs of concept and garner support among authorities who can then establish binding rules. Here,

[13] The power of "soft law," emanating from ratings, rankings, and awards, has been shown in a wide variety of contexts such as university administration (Espeland and Sauder 2016) and corporate environmental conduct (Sharkey and Bromley 2015). Like other forms of external appraisal, certifications remain voluntary. However, organizations do change their behaviors in the face of private regulation because they engage in status competition, demonstrate clear membership in a category, and recalibrate their cognitive maps (Sauder, Lynn, and Podolny 2012; Brandtner 2017). These mechanisms shape behaviors of both private and public participants of urban governance.

green construction incentives and requirements have statistically similar effects, which reinforces the argument that the primary mechanism through which policy stimulates practice uptake is its legitimation of an action rather than a forcing of their hand (Rea 2017).

The model has general implications for understanding how governance networks encounter innovative practices before they are established as legitimate. To test the conditions of distributed adoption beyond climate policy, researchers could collect observations of a wide variety of social, political, and economic practices. Researchers could investigate patterns in private developers' adoption of tax incentives to invest in so-called opportunity zones and how local businesses come to accept municipal identification cards that cities issue to give undocumented immigrants access to city services (de Graauw 2014). This quest invites the development of a longitudinal index of urban innovations, akin to state policy innovativeness scores (Walker 1969; Boehmke and Skinner 2012). Some challenges include the underrepresentation of small cities in many data sources, missing information on dates of adoption, and the necessary arbitrariness of any list of policies. Adoption information from advocacy organizations, for instance, provided the basis for the insightful studies by Martin (2001) and Vasi and Strang (2009). Less politically contentious issues than a living wage and human rights may not have the same availability of data. Additionally, welfare and civil liberties are polarizing political issues for which the civic and state capacities to adopt (latent) and actual adoption (observable) can diverge because of a lack of political opportunity or will. Overcoming these challenges can provide a richer view on urban change and stasis that would be sensitive to the important role of organizations in making cities distinctive from each other while being embedded in a shared social structure.

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