Leaders, Followers and Laggards:

Committing to Local Climate Actions in California

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Abstract: Very limited amount of research has been devoted to climate actions at the local level in comparison to those at federal and state levels. It is unclear why some cities acted as leaders in the fight against climate change, some acted as followers, while others remained laggards. This study critically examines the major hypotheses about voluntary local climate actions so that we can better understand factors affecting local political will to commit to climate actions. Understanding these factors will increase our ability to design policies and strategies that enable more local voluntary participation in climate actions. Applying a survival analysis to the participation of California cities in the U.S. Conference of Mayors' Climate Protection Agreement, this paper explains the temporal and spatial diffusion of local political will to take climate actions. The analysis examines whether the timing of cities' participation in the Mayors' Agreement is associated with a broad range of characteristics, such as: local demographics; government form and size; political preference and environmentalism; local air quality and congestion level; and behavior of neighboring jurisdictions. Results support the importance of income level, political preference and environmentalism of the local communities, as well as a city's administrative capacity and autonomy. Congestion relief seems to be an important co-benefit motivating cities to reduce greenhouse gas emissions. However, average education level does not seem to affect local political will to act on climate change, nor does per capita number of planning professionals. The importance of individual political leadership also does not seem to be supported by our analysis.

Keywords: Voluntary local climate actions; political commitment; U.S. Conference of Mayors' Climate Protection Agreement; California

The role of local government in greenhouse gas (GHG) emissions reduction has drawn an increased amount of attention for several reasons. First, the projected failure to achieve the Kyoto Protocol targets by the major industrialized nations participating in the treaty signals that focusing on national and industrial policies, e.g., carbon credit trading, may be insufficient to meet our goals in a timely fashion. In addition, the potential for carbon reduction and ancillary benefits of local climate actions have been recognized by more and more researchers and policy makers such as the California Environmental Protection Agency (Climate Action Team, 2006). The proven effectiveness of state and local voluntary measures strongly argues for the position of these actions as an integrated part of, rather than being substituted by, the emerging federal climate policies under President Obama's administration (Lutsey & Sperling, 2008). Secondly, local governments' own distinctive policies, such as zoning, building codes and municipal services, have profound effects on carbon intensities of major GHG-emitting sectors such as transportation, energy, water and solid waste. Also, local governments' willingness to cooperate with their neighbors is crucial to the success of regional policy measures, an emerging climate policy area pioneered by the state of California, through its Senate Bill 375, to link regional development patterns with GHG emissions. Finally, compared to top-down policies and programs, localized measures can be designed to match unique local circumstances and be implemented with less bureaucratic impediments. They can also be monitored more directly and adjusted more quickly.

There is, unfortunately, a gap in academic literature on voluntary climate actions at the local government level. Although a large literature exists on voluntary actions taken by industries (Dietz & Stern, 2002; OECD, 1999, 2003) and households (Rege &

Telle 2004; Kahn, 2007; Kotchen & Moore, 2007, 2008), their findings may not apply to cities, where voluntary carbon reduction has different aims and is implemented in a much broader social context. Among the handful of studies on local climate actions, almost all are case analyses that provide detailed information on the process of local climate actions (Betsill, 2001, Betsill & Bulkeley, 2006; Engel & Orbach, 2008). They tend to rely on intuitive explanations about motivations and mechanisms instead of robust hypothesis testing. For example, Betsill (2001) indicates that localizing the global climate issue is key to political support, but they fail to demonstrate why some cities were able to frame global climate change as a local problem much earlier than others. Kousky and Schneider (2003) highlight the importance of local co-benefits of controlling GHG emissions, but they cannot explain why many cities bothered to link climate change to local issues instead of acting directly to address them. Very few published studies try to quantify the relationship between city characteristics and carbon reduction commitment. Zahran et al. (2009) analyze the correlates of climate action commitment by U.S. metropolitan statistical areas (MSAs) through looking at some aggregate measures of local climate change risks, emission intensities and local socio-demographic characteristics. However, their analysis may only help explain the difference between two groups of MSAs depending on whether they have committed to a climate action program at a single point in time. Such treatment loses important information carried by the diffusion of local policy innovations, given that the number of cities taking climate actions has been continuously growing in recent years.

On February 16, 2005, when the Kyoto Protocol became law for the countries that had ratified it, Seattle Mayor Greg Nickels launched an initiative to advance the goals of the Kyoto Protocol through leadership and action by American cities willing to participate. By June 2005, 141 mayors had signed the U.S. Conference of Mayors' Climate Protection Agreement (MCPA), vowing to reduce carbon emissions in their cities below 1990 levels, in line with the Kyoto Protocol. The number of signees quickly rose to 967 as of August 21, 2009. [1]

The climate action commitments of these cities raise two questions. What determines a city's participation in MCPA? Why did cities act differently – some as leaders, some as followers, while some as laggards? Using the time sequence of cities' participation in MCPA, this study tries to address the gap left by previous studies on local climate actions. The remainder of this paper presents major hypotheses explaining local voluntary climate actions, followed by descriptions of data and methodology. After presenting the results, the paper concludes with policy implications, limitations, and future research possibilities.

Hypotheses about Local Voluntary Climate Actions

As a standard example of free riding, voluntary GHG emissions mitigation at the local level seems difficult to be interpreted as a rational choice. In reality, however, the driven forces of local political will to take climate actions can come from a mixture of local collective or individual self-interests, behavioral biases and true environmental altruism, as postulated by Engel and Orbach (2008). Listed below are several major theories and hypotheses potentially applicable to explain local voluntary climate actions.

Income effect is perhaps better known as the *environmental Kuznets curve* (Kahn, 2006). Indicated by Kahn's comparison between smart growth cities and "brown" cities, people with higher income levels tend to care more about quality of life issues, and wealthier communities with more resources and expertise are more capable of creating strategies and implementing them. Whether the environmental Kuznets curve extends to the realm of climate change remains a question. A reasonable hypothesis is that wealthier communities are more concerned with climate change and willing to act faster. This may prove true, given that as local communities aim to lessen their environmental impact, but continue wanting the same goods, wealthier communities can afford to substitute environmentally harmful industries and behaviors with those less so. Meanwhile, poor communities are often constrained by their budgets, and have fewer choices (Betsill, 2001).

Administrative capacity refers to a city's ability to motivate and coordinate its resources, particularly the necessary human skills to address the complex issue of local GHG emissions. A wealthier city government is certainly more capable, in terms of its available fiscal resources, to address this issue. For example, funds can be used to enhance their technical capacity by consulting organizations like ICLEI. Given the same level of per capita government expenditure, a city with more per capita planning or sustainability-related staff may also have higher administrative capacity to design and implement climate policies. It is likely that economies of scale exist in administrative capacity on specialized issues such as climate actions. This indicates that a larger city may have dedicated personnel for climate and sustainability issues, while a smaller but wealthier city may not.

Vulnerability perception stresses the fact that people will react when they feel threatened. The local effects of climate change can sometimes be a part of daily life experienced by a community, rather than being uncertain and intangible. Weather fluctuations, smoggy air, or wildfires can compromise local economies and force traditional forms of economic activity to adapt if the hazards are sufficiently severe and/or frequent. Subsequently, the affected communities are more motivated to mitigate future upheaval than those not directly affected by climate change. For example, one of the deciding factors that influenced the City of Durban, South Africa to pursue climate actions included “a series of extreme weather events” which threatened the city (Roberts, 2008).

One way to test the vulnerability hypothesis might be looking at the association between local climate actions and the extent to which the local economy may be affected by climate change, such as the portion of economic activities based on the weather and/or the ecosystem. However, due to the many unknowns in climate vulnerabilities of localities, what matters most is perhaps not the scientifically measured vulnerability of each community, but the *perceived* vulnerability. The education attainment of the citizens may play a role in this perception. To most local communities, climate change is an abstract theory not directly experienced on a daily basis. Education provides people with the ability to better understand complex issues such as the risks associated with global climate change (Kahn, 2006). Thus, cities populated by citizens with higher educational attainment are expected to be more responsive to climate change, as these individuals can more readily grasp the complexities of the issue.

Neighboring effect, also known as *pear influence*, hypothesizes the positive correlation between a city and its surrounding jurisdictions with respect to climate actions. This is similar to the hypothesis that individuals are more likely to accept a more environmentally friendly lifestyle if their neighbors do. The underlying mechanism of neighboring effect can be a broad range of connections among peer jurisdictions including the simple transfer of climate change knowledge between local political elites, the diffusion of environmentalism among neighboring communities, the influence of regional top-down policies, and the economies of scales that occur when neighboring cities undertake joint efforts.

Energy efficiency gap is widely described as “doing better by doing good.” This theory hypothesizes that a family, firm or community may save costs by adopting greener or more efficient products, technologies or practices. For example, cities may claim reductions in municipal operating costs by investing in energy efficient buildings and infrastructures. However, disagreements remain on whether an energy efficiency gap truly exist and why – more specifically, whether there are significant market or organizational failures leading to the efficiency gap, and whether there are some hidden costs preventing the adoption of new technologies (Jeffe & Stavins, 1994; Levine et al., 1995). While savings in municipal operating costs seem applicable to all cities, the magnitude of net benefit may differ across cities when a specific technology is adopted. As a result, ample sunlight might facilitate the adoption of solar technologies by a city, while cities like Portland and Seattle may be less willing to consider such technologies.

Local social co-benefits exist mainly because GHGs are often emitted by activities that produce other non-market costs to the society. Even if climate policies cannot be implemented at a net savings or zero cost, they often generate local co-benefits that help localize climate issues, which may convince the public to support climate policies. For example, the sheer amount of vehicle-miles traveled in California produces not only GHGs, but also congestion and conventional air pollution. However, the significance of the effects of local co-benefits such as air quality improvement and congestion relief have to be tested, as poor air quality and congestion may be results of higher concentrations of population and economic activity.

Local interest groups may be another explanation of cities acting as leaders, followers, or laggards on climate actions. Vocal individual environmentalists, organized local environmental groups, and those in the "green" industries may act to increase the social awareness of climate change and influence political decisions. Conversely, local interest groups that see a certain climate policy as not in their interest may oppose the policy and even impede the overall idea of climate change mitigation.

Local governance structure includes many aspects that characterize a local government, such as (1) the influential power of individual political leaders on public policy, and (2) a local jurisdiction's degree of autonomy with respect to associated upper-level governments. A stronger mayor may break the traditional bureaucratic structure of the city government so that climate policies can be coordinated across various government departments. Some evidence suggests, "[L]ocal mitigation policy is predominantly a top-down decision based on what officials or staff members believe to be 'good business' or rational economic and political choices" (Kousky & Schneider, 2003, p.361). However, even with local environmental leadership, some administratively less autonomous cities are constrained by state governments when they attempt to further land use or economic development policies (Portney, 2003). In this case, cities with more administrative autonomy are more likely to lead policy innovations.

Political entrepreneurship may explain local elected or appointed officials' efforts to initiate local climate actions as a way to further their career and popularity (Engel & Orbach, 2008). Such efforts become political opportunism if an official makes policy decisions solely depending on whether her action will help advance her career. It may be difficult to differentiate such individual incentives from other motivations, even if we know the exact position held by an official in a policy decision process.

Data on the Mayors' Climate Protection Agreement and Participating Cities

This study uses the timing of local governments' carbon reduction commitments in California – the history of cities' participation in MCPA. The U.S. Conference of Mayors is the official nonpartisan organization of cities with populations of 30,000 or more. MCPA has the largest number of city members (969) nationally, in comparison to the other major voluntary climate programs involving local governments -- the International Council for Local Environmental Initiatives' Cities for Climate Protection (ICLEI-CCP) and the California Climate Action Registry (CCAR). ICLEI boasts 545 members and CCAR 23, but both programs include significant number of other types of local governments. In addition, CCAR focuses specifically on GHG emissions inventory rather than a broader range of local climate actions promoted by MCPA and ICLEI-CCP. ICLEI-CCP strategically targets specific cities and charges annual membership fees, while MCPA is open to all city mayors willing to proclaim their climate policy position.

Cities participated in MCPA commit to taking three actions: (1) strive to meet or exceed the Kyoto Protocol targets (seven percent below 1990 GHG emission levels by 2012) in their own communities through various local policies, projects and campaigns;

(2) urge their state governments and the federal government to enact policies and programs to meet or exceed the Kyoto Protocol targets; and (3) urge the U.S. Congress to pass comprehensive bipartisan GHG reduction legislation. Beginning on February 16, 2005, membership of MCPA has grown steadily. Nonetheless, by the end of 2008, 147 out of the 230 California cities with populations greater than 30,000 (based on 2005 Census estimates) still had not signed MCPA. Among the 83 signatories of the agreement, three are known to be among the initiators the agreement, and 72 have made their signatory date available to us.

Figure 1 shows the progress of California cities' participation in MCPA up until the end of 2008. [2] The unconditional Kaplan-Meier survival curve shows the percentage of uncommitted cities over time. The membership growth rate in California varied slightly throughout the time period. By late 2008, about 64 percent of cities with populations greater than 30,000 had not signed MCPA.

[Figure 1 about here]

To explain the pattern in Figure 1, this study constructs a database with a comprehensive set of characteristics that may be associated with a city's voluntary climate action, including: socio-demographics; political preference and environmentalism; government capacity and structure; local climate and measures of potential co-benefits of climate policies. Table 1 lists the definition, source and description of the dataset.

[Table 1 about here]

Population size (and the highly correlated total city government expenditure) indicates a city's overall administrative capacity, which is expected to positively affect a city's likelihood of adopting MCPA. As indicated by the hypothetical mechanism of economies of scale, however, the effect of the overall administrative capacity on the likelihood of adopting MCPA may not be linear. Two variables are used to measure a city government's capacity to implement climate actions in addition to population size. Per capita government expenditure represents the amount of resources a city government may spend at the per capita level. The number of planning professionals in a city may indicate the level of technical capacity available to implement climate policy and planning actions.

Average household annual income and percentage of population with bachelor degrees are obtained by matching the 2000 Census data at the place-level to the cities. [3] We also include population racial compositions as they often reflect the socio-economic status of a population, as well as potential cultural characteristics. We use percentage of registered Democratic voters to represent the general political preference of the local population, and use the percentage of registered Green Party voters to indicate the local population's preference for environmental protection. Surprisingly, the correlations among the preference variables are fairly weak, especially between the percentage of Democratic voters and the environmentalism variables (a mere .27 coefficient).

The political and administrative structures of the local government are measured by three aspects. Local administrative autonomy is measured by a city's status as a charter city or a city governed by the California general law. The establishment of a mayor-council or a council-manager leadership structure represents the strength of a mayor's ability to make decisions based on his/her personal political agenda. For example, a majority council vote may not be necessary to approve a policy decision if an influential mayor governs a city. We measure how closely a mayor's political decisions are aligned with the majority of voters by whether a city's mayor is elected through direct election or some other method.

We measure two social co-benefits of climate policies: local air quality and traffic congestion. We document whether a city is located within a nonattainment county/air basin, as designated by the U.S. EPA. The number of injuries in traffic collisions, standardized by population, is used as a proxy, due to the lack of more accurate indicators of traffic congestion. [4]

Local climate variables reflect multiple characteristics of a city. Climate directly affects the energy use pattern of a city, mainly through indoor climate control and water use. Local climate characteristics also reflect local vulnerabilities to climate change risks such as sea level rise and wildfires in California. The desirability to live in a specific climate can be correlated with population groups who differ in preference, as suggested by Glaeser and Kahn (2008).

Methodology

We use a survival model (also known as the duration model) to analyze participation in MCPA. We estimate a hazard rate, h, which is the conditional probability that a California city joins MCPA at time t, given that the city has not already joined, and given the characteristics of the city at time t. A survival analysis is appropriate for analyzing the effects of a city's characteristics on its participation in MCPA because it explicitly accounts for the intertemporal relationship of cities' participation. This differs from the simple cross-sectional probit or logit model because some of the cities that were not participating at the time when the participation data was collected may have joined later. A survival model circumvents this problem by estimating the conditional probability of participation at each time point when a new city (or new cities, if there is a tie) joined MCPA.

There are two broad approaches to specifying survival models. The parametric models assume specific forms of time-dependence of the probability density function. Common assumptions include exponential, Weibull, and log-logistic distributions. However, parametric models are difficult to specify in this study for many reasons. For example, one would expect that the longer a city has not signed MCPA at any given time, the more likely it will sign. This is because firstly, more knowledge and information about climate change will be accumulated and available to the local communities; secondly, the city will more likely become a target of national or international environmentalists; and finally, the city may feel more peer pressure as more neighboring jurisdictions become signees. Conversely, one may expect the reverse to happen because the longer a city has not signed MCPA, the less likely local supporters may be passionate about climate change, as pointed out by Downs' (1972) "issue attention cycle", and the fewer pro-environment voters will remain in the community. Together these factors indicate that commitment dynamics are likely to produce non-monotonic hazards, while the exact trends are unclear.

The semi-parametric models do not require a parametric assumption about the density function. Instead, this method breaks the hazard rate down into two components: (1) a baseline hazard that is a function solely of time and is assumed to be constant across all cities, and (2) a component that is a function of the explanatory variables. We chose the most commonly used Cox (1975) proportional hazard model for this study. The Cox proportional hazard model further assumes that a city's hazard rate is proportional to the baseline hazard, and the ratio is represented as an exponential function of the explanatory variables that differentiate one city from the others. The Cox proportional hazard model provides estimates of coefficients (frequently given directly in exponential form and referred to as "hazard ratios"), which show how each of the covariates may affect the hazard rate relative to a common baseline. The coefficients are estimated using maximum likelihood. Days serve as the temporal unit of analysis and the Breslow (1974) method to treat ties.

Results

Table 2 summarizes the maximum likelihood estimates from survival analyses in five alternative specifications. Standard errors reported are adjusted to county-level clusters. Overall, results across different model specifications are quite consistent. We use results from Model 3 when estimating the impacts of variations in independent variables.

[Table 2 about here]

The probability of a city signing MCPA increases as population increases (or the size of the local government expenditure), although at a slowly decreasing pace, as can be seen from the coefficient of the secondary term. For cities with small to medium-sized populations (e.g., under half million), a population increase of about 300,000 roughly doubles the likelihood of signing MCPA. Such positive effects diminish gradually until the city population reaches about 3 million. If per capita government resources do not positively correlate with the hazard (as suggested by the small and significant coefficient estimate of per capita government expenditure), this total size effect may indicate some kind of economies of scale in local climate policies for cities with fewer than three million residents.

As expected, average income and education levels are highly correlated, and our models show both coefficients have a positive correlation with cities' participation in MCPA. However, the effect of the percentage of population with bachelor degrees becomes statistically insignificant once average household income is controlled in the regression. A standard deviation (about $21,400 per annual household) higher in average household income reflects a 47 percent increase in the likelihood a city signs MCPA.

Both percentages of registered Democrats and Green Party members are positively associated with cities' participation in MCPA. A city with a share of Democratic voters that is one standard deviation (about 12%) higher is expected to reflect a 45 percent increase in the likelihood that the city signs the Agreement. One standard deviation (about 0.44 percent) increase in the share of Green Party voters in a city is associated with an 84 percent increase in the likelihood of signing. However, the magnitude and level of statistical significance varies across our models. When both percentages of Democratic and Green Party voters are included in the regression, the latter variable's influence becomes less stable and less statistically significant. Overall, the evidence still seems to support positive associations between local environmentalism and local voluntary climate actions. The coefficient estimates of Green Party voter share is less stable across models, indicating that this variable might be an imperfect measure of local environmentalism.

Although the total size of the local government matters, and is almost proportional to population size, two other measures of local government capacity do not strongly support the positive relationship between government capacity and voluntary climate actions. Both per capita governmental expenditure and per capita number of planners seem to be positively associated with cities' participation in MCPA, but only the per capita number of planners shows some marginal statistical significance in our models.

Among all the measures of local government structure, the charter city dummy variable stands out as a powerful predictor of voluntary climate actions of the cities. Other things equal, charter cities are more than twice as likely to participate in MCPA as general-law cities. This may indicate that administrative autonomy – the ability to create a city's "own rules" – may free the cities from governing in the conventional ways specified by general law at the state level, and allow them to adopt progressive policies. On the other hand, whether a strong mayoral government exists or whether the mayor is directly elected does not seem to make a difference (if not in the negative way). This poses a question on the important role of individual political leadership suggested by Kousky and Schneider's (2003) survey.

Estimated impacts of air quality and per capita traffic injuries partially support the co-benefits hypothesis. One standard deviation (about four cases per thousand people) in traffic injury per thousand people roughly increases the hazard by more than 26 percent. Cities within the nonattainment area seem to be more likely to participate in MCPA, but this result lacks statistical significance. These results suggest that people may be more aware of or concerned with the interconnection between driving, congestion and climate change, but less aware of conventional air pollution.

Perhaps the biggest surprise of our analysis is the strong negative association between a city's likelihood to participate in MCPA and the percentage of participation among its peer cities within the same county. All else equal, one mayor will be almost 50 percent less likely to sign MCPA than the other mayor if her peer cities' participation rate is 25 percent higher. This seemingly erroneous effect is strong and consistent across our models. A possible explanation for this result is political opportunism of the mayors. Namely, a mayor is more likely to make a political commitment when she finds that by making the commitment she will be a leader among her peers instead of a follower, as long as such a commitment remains voluntary and no penalty will be applied to the laggards.

Models 4 and 5 test the effects of race and climate of local communities, respectively. As one would expect, after controlling other variables, none of the race and climate variables show statistically significant impacts on local voluntary climate actions. In California, precipitation and temperature often reflect the potential vulnerability of a city to climate change hazards such as sea level rise and wildfires. The insignificance of the two climate variables seems to indicate that such vulnerabilities were not well perceived, and/or perceived vulnerabilities did not translated into local willingness to mitigate GHG emissions.

Conclusion and Discussion

The timing of policy responses to climate change is critical as the stock of GHG increases and climate risks accumulates. This paper quantitatively studies the timing of local governments' commitments to climate actions.

Our results confirm some hypotheses regarding local voluntary climate policies. The overall capacity of local jurisdiction, measured by population size (or total local government budget), affects the likelihood of joining MCPA. Local communities with higher average household income are more likely to be leaders in climate actions. This seems supportive of the carbon emissions Kuznets curve and previous observations on local awareness of conventional environmental issues, such as those by Kahn (2006). Both general political preference and local environmentalism exhibit significant impacts on local willingness to take climate actions. Charter cities' significantly higher likelihood of joining MCPA indicates that administrative autonomy or "home rule" probably has an impact. An increase in the per capita number of traffic injuries significantly improves the likelihood to act on climate change, showing that traffic congestion alleviation and/or safety improvement might be perceived as an important co-benefit of climate actions.

Some hypotheses do not receive strong support from the results. Education level of the citizens may not be important if average household income is held constant. Capacity of a local government measured by per capita government expenditure and per capita number of planners do not seem to be crucial in forming the local political will on climate issues. The results also fail to support the importance of individual political leadership in climate policy because neither a strong mayoral government nor a directly elected mayor demonstrates significant impact. The insignificance of the climate variables may indicate that climate vulnerabilities are either not well perceived or considered less compelling. This is consistent with the findings of Zahran et al. (2009) regarding the effect of climate change risks on MSAs' climate commitments. Lastly, our result clearly rejects the hypothesis of positive peer influence among cities. In fact, they even indicate the existence of political opportunism.

One could argue that political commitments by the mayors sometimes do not translate into meaningful actions and may be largely irrelevant. Indeed, it would be ideal to analyze substantial climate actions instead of just political commitments if reliable data were available. However, political commitments by a mayor and his/her council are usually backed by a significant number of constituents. In addition, they are often important political strategies necessary to catalyze a series of local climate actions. The experience of cities' participation in the Mayors' Climate Protection Agreement in California suggests that the leaders and the laggards do differ in multiple aspects, including the characteristics of local communities and how they are governed.

Understanding what truly drives the voluntary actions at the local level may help federal and state policy makers design policies that are more compatible with local incentives and more cost-effective to implement. This study can thus be improved by addressing the endogenous variable problem, enabling us to address questions such as, "Does the fact that larger cities are more likely to take climate actions reflect unmeasured selection or economies of scale?" Although difficult, more data should be collected to illuminate the effects of personal traits of local political leaders, perceived local climate vulnerability and local interest groups. In further studies, it is essential in the next step to analyze substantial climate actions taken by cities to see why some have been able to move beyond political rhetoric to substantial actions. Finally, important policy implications can be gleaned by exploring the potential effects of more aggressive federal policies on local governments' climate actions.

Notes

1. Data are taken from the U.S. Conference of Mayors Climate Protection Center (http://www.usmayors.org/climateprotection/revised/), retrieved on August 21, 2009.

2. We strategically chose the "right censoring" date to avoid possible impacts on cities' primary motives given the change of national environmental politics following the 2008 presidential election.

3. The author thanks Professor Matthew E. Kahn for sharing California cities' income and education data.

4. The number of fatalities, perhaps surprisingly, is uncorrelated with the number of injuries. This may indicate that the number of injuries better reflects congestion levels. Traffic fatalities more strongly reflect high driving speeds, which are negatively correlated with congestion level.

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Table 1: Definition and source of cities' characteristics

Data	Source
Socio-Demographics	
Population in 2005 (thousands)	Municipal Year Book 2005 and U.S. Census
Percentage of Hispanic population in 2000	U.S. Census
Percentage of black population in 2000	U.S. Census
Percentage of Asian American in 2000	U.S. Census
Average household income (in 2000 $)	U.S. Census
Percentage of BA graduates in 2000	U.S. Census
Political preference and environmentalism	
Percentage of registered Democratic voters in Oct. 2008 election	California Secretary of State
Percentage of registered Green Party voters in Oct. 2008 election	California Secretary of State
Dummy indicating existence of a local league of the California League of Conservation Voters in a city (yes=1, no=0)	California League of Conservation Voters
Government capacity	
Number of planners (per thousand persons)	Governor's Office of Planning and Research, California
Per capita total government expenditure in 2000 (dollars)	County and City Data Books, the University of Virginia Library
Government structure	
Charter city dummy (yes=1, no=0)	League of California Cities
Strong mayor dummy (yes=1, no=0)	Municipal Year Book 2008
Directly elected mayor dummy as of Jun 2007 (yes=1, no=0)	League of California Cities
Measures of potential co-benefits	
U.S. EPA Currently Designated Nonattainment Areas for All Criteria Pollutants (counties), as of Dec. 18, 2008. (attainment or marginal=0, nonattainment or serious=1)	U.S. EPA
Total traffic injuries per thousand people, 2007	California Highway Patrol
Local climate	
Average annual precipitation (inches) from 1971-2000	County and City Data Books, the University of Virginia Library
Average cooling degree-days from 1971-2000	County and City Data Books, the University of Virginia Library

Table 2: Hazard ratio coefficients from survival analyses [a]

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
population	1.003261* (0.054)	1.003364** (0.041)	1.003203** (0.038)	1.003208** (0.032)	1.003699** (0.024)
$(population)^2$	0.9999995* (0.08)	0.9999994** (0.047)	0.9999995** (0.039)	0.9999995** (0.039)	0.9999994** (0.02)
income			1.000022*** (0.002)	1.000026*** (0.001)	1.000019** (0.013)
pct. college grad	1.020159* (0.071)	1.030509** (0.012)	1.004568 (0.768)	0.9802583 (0.246)	1.006246 (0.688)
pct. Democrat		1.035775** (0.026)	1.038263** (0.019)	1.056953*** (0.006)	1.033086* (0.07)
pct. Green	1.953259** (0.042)	1.350509 (0.392)	1.91064* (0.073)	1.760096 (0.124)	1.560368 (0.173)
per cap gov't expenditure	1.000307 (0.172)	1.000193 (0.32)	1.000074 (0.707)	0.9999623 (0.853)	1.00008 (0.693)
per cap no. of planners	1.192522 (0.568)	1.298821 (0.322)	1.436643 (0.122)	1.697857* (0.062)	1.418389 (0.132)
charter city	2.083095*** (0.01)	2.212598*** (0.008)	2.378397*** (0.009)	2.497109** (0.011)	2.250066** (0.013)
strong mayor	0.1196552 (0.265)	0.1637117 (0.301)	0.230828 (0.39)	0.2790807 (0.437)	0.1975593 (0.362)
directly elected mayor	1.310246 (0.475)	1.392227 (0.391)	1.60546 (0.241)	1.646525 (0.198)	1.509553 (0.33)
air quality non-attainment	2.171009* (0.091)	2.002178* (0.096)	1.602376 (0.259)	1.456421 (0.36)	1.297692 (0.544)
per cap. no. of traffic injuries	1.080804** (0.014)	1.090894*** (0.006)	1.068132* (0.087)	1.064589* (0.079)	1.071409* (0.059)
pct. peer cities signed	0.9861128 (0.124)	0.9832421* (0.084)	0.9810453* (0.058)	0.9786026** (0.048)	0.9819463* (0.07)
pct. Hispanic				0.9777983 (0.107)	
pct. black				0.9810766 (0.292)	
pct. Asian				1.014922 (0.27)	
avg. precipitation					1.027977 (0.205)
avg. cooling degree days					0.9996685 (0.342)

*a. P>|z| in parentheses; ***, ** and * represent significance at levels of 1%, 5 % and 10%, respectively.*

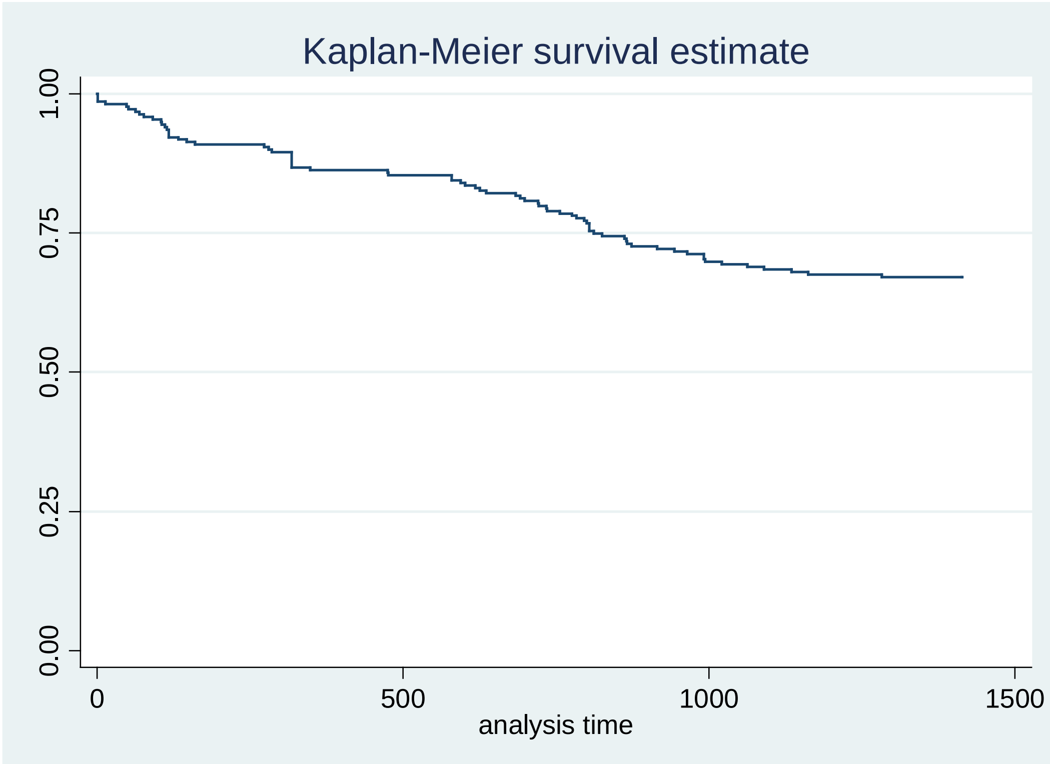

Figure 1: Progress of California cities' (population > 30,000) participation in MCPA