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Adoption and Enforcement of Earthquake Risk-Reduction Measures

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ABSTRACT

These combined studies explore the socio-political implications of the seismic provisions of local building codes. Based on results from a national survey of building code officials, these three complementary studies explore (1) making building codes effective tools in earthquake hazard mitigation at the national level (2) the policy challenges of seismic mitigation in the western U.S., and (3) the role of policy entrepreneurs in the adoption of seismic-related provisions by local governments within California.

The conclusions of these studies are diverse, exploring various aspects of the role of federal, state, and local governments in the establishment of seismic provisions of building codes and the enforcement of those provisions. The studies find that the regulatory approaches adopted by federal and state governments are important for understanding local enforcement of building code provisions.

These studies call attention to the role of state requirements and the influence of differing local political and economic contexts in shaping regulatory actions by local governments. The adoption of seismic regulations and priorities for their enforcement by local governments are strongly influenced by state requirements and by the extent of the problem. The adoption of regulations is more responsive to past earthquakes, whereas the enforcement priority that local building departments give to seismic provisions of building codes is more responsive to the extent of the earthquake hazard.

Finally, this research explores the impact of entrepreneurial politics on the regulation of public risks with attention to patterns of entrepreneurial influence in local government within California. In doing so, it lays the groundwork for future efforts to further examine the peculiar contributions of public entrepreneurs to seismic mitigation efforts.

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CONTENTS

1 Introduction

All or parts of 39 states in the U.S. lie in regions classified as having potentially damaging earthquake hazards. Within the western states (including Hawaii and Alaska), 52 million people are exposed to seismic hazards that include the potential for extreme ground shaking, surface faulting, ground failures, and earthquake-induced tsunamis. There is considerable variation in how federal, state, and local officials react to seismic hazards. What follows are three complementary studies that explore the implications of this variation, and attempt to understand the socio-political mechanisms responsible for them.

Chapter 2, authored by Raymond Burby and Peter May, has been selected for publication in an upcoming volume of the journal *Environmental Hazards*. This research reveals a striking difference between the strong role of states in influencing local priorities for enforcing energy-efficiency provisions of codes and their lesser roles in influencing priorities for enforcing seismic provisions of codes. These differences can in turn be traced to the substantial disparity between federal energy efficiency and seismic safety programs. This does not mean that federal efforts to strengthen seismic code provisions have been wholly ineffective. But our research suggests that the current national effort in this regard is too small to have a discernible impact on the priorities that local officials in many parts of the country attach to seismic hazards.

One implication of this research is that the federal government can potentially play an important role in advancing state and local efforts to adopt and enforce seismic provisions of building codes. In some cases, this positive federal role could be relatively inexpensive to initiate. For example, the adoption of a state building code with seismic provisions could be a condition for receiving disaster assistance or other forms of federal funding.

Another lesson we draw is the importance of education, training, and grants-in-aid that are targeted to local governments and are specific to enforcement of particular code provisions. These mechanisms are critical for raising the commitment and capacity of local personnel to enforce seismic and other code provisions. Although the implications and lessons learned are specific to the United States, the more general intergovernmental issues and lessons potentially apply to other countries with multi-tiered governmental structures.

Chapter 3, authored by Peter May and T. Jens Feeley, deals with seismic mitigation in the western U.S. as an example of a low-salience public policy. The results of this study, which are to be published in an upcoming issue of the journal *State and Local Government Review*, clearly show that earthquake risk reduction entails different regulatory politics and challenges than those of more salient and immediate problems. The lack of a widespread public constituency advocating seismic risk reduction and the limited concerns of local officials about earthquake risks create minimal incentives for local governments to address these issues. This study concludes that the adoption of seismic regulations and priorities for their enforcement by local governments are strongly influenced by state requirements and by the extent of the problem. The adoption of regulations is more responsive to past earthquakes, whereas the enforcement priority that local building departments give to seismic provisions of building codes is more responsive to the extent of the earthquake hazard. We also found evidence that the political dynamic in the aftermath of major events is similar to that of regulatory issues with high salience.

A second observation is that politics is not entirely absent from low-salience issues, even in the absence of major events. We find that local building departments tailor their efforts in response to the demands of relevant interested parties and respond to the involvement of elected officials in agency decision-making about enforcement tasks. In other words, the politics surround seismic mitigation is not totally bloodless, but it is also not full of the high drama associated with more salient regulatory issues.

The final chapter, **chapter 4**, authored by Robert Wood, explores the influences and limits of political entrepreneurs on seismic mitigation efforts in California. This research demonstrates that entrepreneurs are just as important for determining seismic policy as for public goods, and that entrepreneurs from within the policy system are particularly effective at achieving their policy goals.

A number of important lessons can be drawn about the role of entrepreneurial politics at the local level. We find that local elected officials play a powerful role in shaping the course of seismic regulation in their communities, and local building officials even more so. In cities and counties where they are supportive of strong seismic regulation, strong programs are in place. Similarly, we find that interest groups, particularly advocacy groups, are a powerful source of entrepreneurs. In fact, entrepreneurial groups are found to be more influential in explaining the adoption of local seismic provisions than state mandates, past disasters, local economic conditions, or even the level of risk in the community. Yet despite the importance of entrepreneurial groups, we understand little about the conditions that lead to their activation, and even less about their motivation and behavior. This research uncovers some of the entrepreneur's place in local politics and lays the groundwork for future efforts to further examine the peculiar contributions of public entrepreneurs to seismic mitigation efforts.

2 Making Building Codes an Effective Tool for Earthquake Hazard Mitigation

RAYMOND J. BURBY AND PETER J. MAY

2.1 INTRODUCTION

Building codes are key instruments for improving the resilience of the built environment to lessen the damaging impacts of earthquakes and other natural hazards. The limited loss of life from major disasters in the United States, as in other countries with extensive regulation of building safety, is often cited as evidence of exemplary building practices. However more cautionary assessments are provided by investigations undertaken in the aftermath of major disasters in the United States that document inadequacies in the performance of buildings. The California Seismic Safety Commission's investigation (1995) of damage from the Northridge earthquake in southern California found that there would have been far less damage had building codes been rigorously enforced. Similar reports following Hurricane Andrew's devastation in southern Florida in 1992 attributed a quarter of insured losses to code violations (Insurance Institute for Property Loss Reduction 1995).

After such revelations, stronger *standards* for building codes are often suggested despite the attention these investigations also call to inadequacies in the *enforcement* of building codes. These failures in enforcement undermine the effectiveness of building codes and present a challenge in figuring out how to bring about stronger implementation of code provisions. This issue has been examined in recent research by Burby and his colleagues (1998a) in studying patterns of damage after the Northridge earthquake and by Olshansky (1998) in commentary about the adoption of seismic provisions for building codes by states. In this article, we employ data from experiences in the United States with code enforcement to provide an empirical basis for advice on how to make building codes more effective tools for earthquake hazard mitigation.

Traditionally, building codes and code enforcement in the United States have been a state and local governmental responsibility. Unlike other societal problems, the federal government has made only limited, sporadic attempts to influence the development of building standards and local enforcement practices. When federal legislation was proposed following reports by the Advisory Commission on Intergovernmental Relations (1966) and the National Commission on Urban Problems (1968) that were critical of local code enforcement, the legislative effort elicited widespread opposition from the building industry and from state and local officials. As a consequence, no federal legislation was enacted.

This hands-off federal stance has provided states with wide latitude in developing policy and programs to foster safe construction (see May et al. 1995, and May 1997). The resulting variation in state approaches to building codes creates an opportunity to learn from state successes and failures in regulating the construction of buildings. In this article, we compare the extensive federal and state efforts to promote the adoption and enforcement of energy-efficiency codes with the more limited efforts with respect to seismic safety as both relate to new construction. Based on this comparison and data on how local governments have responded to state efforts to foster better local enforcement, we develop advice about ways to make the seismic provisions of building codes more effective tools for earthquake hazard mitigation.

We first examine choices the states have made about building code enforcement and what the federal government has done to foster energy efficiency and seismic safety in the built environment. Next, we describe the data assembled to evaluate how state choices and federal policies have affected local governmental priorities. This is followed by consideration of the priority that local building officials give to code provisions related to energy efficiency and seismic safety and the degree to which priority varies because of different state and federal efforts. In the final section, we provide advice for fostering greater attention to enforcement of the seismic provisions of building codes.

2.2 STATE AND FEDERAL REGULATORY ROLES

Wide variation in state approaches to building codes has occurred because the federal government has viewed the safety of buildings as largely a matter for state and local regulation. This has not been the case, however, with respect to the energy efficiency of buildings. This contrast forms the basis for our comparison of differing federal roles in stimulating state and local code enforcement efforts. We consider the differing state and federal regulatory roles in the following sections.

2.2.1 State Approaches to the Regulation of Building Practices

State regulation of building practices relies on provisions of model codes. Since early this century, these codes have been developed by the private sector through a consensus process involving stakeholders that included local building officials, contractors, and design professionals. At present, there are four model codes, each of which has a different geographical basis for adoption. These include the Standard Building Code (most widely used in the southern United States), the National Building Code (most widely used in states along the East Coast), the Uniform Building Code (most widely used in the Midwest and western states), and a separate one- and two-family-dwelling code (used throughout the nation). The organizations that oversee these codes are working to establish a single national model code by the year 2000.

State governments that have enacted building codes generally reference one of the model codes as the technical source of code provisions while enacting their own provisions regarding responsibility for enforcement. Most of the model code seismic provisions relate to new construction, although in recent years greater attention has been given to development of code provisions that are applicable to the rehabilitation of existing buildings. This is especially important because the majority of the buildings that are substantially at risk from earthquake damage are older buildings.

In an examination of state approaches to building regulation, May (1997) found that 17 state governments have very weak approaches to building codes. They either have not adopted a state building code, or they have adopted a code with provisions that apply to only a few types of public buildings.[1] Thirty-three states, however, have chosen to adopt a state building code that applies to most building types and have established a building department to administer the state code. The state building codes typically reference the provisions of one of the model codes and specify a role for local governments in enforcement.

May's analysis of the 33 states with significant building code programs indicated that they could be usefully divided into three groups. He labeled these groups "enabling" (8 states), "mandatory" (13 states), and "energetic" (12 states), based on the degree of state prescription and oversight of local code enforcement practices.[2] The eight states classified as enabling have adopted legislation that authorizes local governments to enforce the state code, but at their discretion. These states have established building departments to administer state code provisions, but the departments pay little attention to review of local code enforcement practices. The 13 states classified as mandatory require, rather than leave to local discretion, enforcement of the state code. Like enabling states, they pay little attention to the extent to which local governments actually adhere to state prescriptions. The 12 states classified as energetic also require local enforcement of the state building code, but state building officials are much more aggressive in their oversight of local government performance.

Our analysis examines the differing state approaches to see how they influence the attention that local governments give to energy and seismic code provisions. We expect local officials to give highest priority to energy efficiency and seismic safety in states with mandatory and energetic approaches to building codes. The adoption of a state building code provides an opportunity to draw attention to state policy objectives. When states require localities to enforce state code provisions (mandatory states), it should be harder for local officials to ignore them. When states actually oversee local performance (energetic states), they have another tool to direct attention to state goals.

The establishment of a state building code function, which has occurred in each of the states that has gone beyond the minimalist approach, also enables states to take steps to increase the capacity of local governments to enforce the building code. This can be important, because without adequate capacity to understand and interpret correctly various code provisions, local officials are likely to pay little attention to their enforcement. Indeed, a study of local capacity to enforce code provisions related to hurricane hazards by the Southern Building Code Congress (1992) found that many building inspectors did not know what the code required, and that their ignorance was a key impediment to effective enforcement. Given this, we expect the priority that local officials give to code provisions concerning energy efficiency and seismic safety to be greater when states have offered training programs for local code enforcement personnel.

2.2.2 Federal Roles in Mobilizing Attention to Code Provisions

The extensive federal effort to promote the adoption and enforcement of energy-related code provisions by the states stands in stark contrast to the more limited effort with respect to code provisions related to seismic safety.[3] The 1973 Organization of Petroleum Exporting States (OPEC) oil embargo led to concern among federal and state officials about rapidly rising energy costs, as well as the availability and adequacy of energy supplies.

These problems created the public support necessary to sustain new initiatives proposed as part of the Carter administration's National Energy Plan, which included requirements for the improvement of the energy efficiency of buildings (Sioshansi 1994). These initiatives included the Energy Policy and Conservation Act of 1975, which created and funded through grants-in-aid the State Energy Conservation Program. The National Energy Plan of 1978 contained the Public Utility Regulatory Policy Act as well as the National Energy Conservation Policy Act. These laws required utilities to establish conservation programs, many of which contain incentives for builders to adhere to stringent energy efficiency standards (U.S. Department of Energy 1997a). The laws also contained incentives for the states to amend their building codes to require adherence to energy efficiency standards and to require localities to have in place building inspection systems to ensure compliance with the new code standards.

As of 1995, thirty-six states had statewide energy codes, ten had codes that applied only to state buildings, and only four states had no code at all (Smith and Nadel 1995). The state codes are based on the Council of American Building Officials' (CABO) Model Energy Code, American Society of Heating, Refrigeration, and Air Conditioning Engineers standard 90.2, and the Building Officials and Code Administrators International National Energy Code (Turchen and Conner 1996). The Energy Policy Act of 1992, the most recent federal energy initiative, references the National Energy Code, which provides an inducement for states to use it to foster energy efficient new construction. State and local government adherence to the code is also fostered by provisions attached to federal mortgage insurance that require compliance with the code as a condition for receiving FHA- and VA-insured mortgages.

In contrast with the substantial number of programs and funding for efforts to foster energy efficiency in the built environment, federal and—except for California—state efforts to foster resilience to earthquake hazards have been meager. May et al. (1998) cites the fact that

$570 million was spent by the federal government in fiscal year 1997 to foster energy efficiency in the built environment of which $150 million went to support state and local programs. In comparison, only $28 million was spent in 1997 for earthquake hazard mitigation programs unrelated to particular earthquake disasters. The National Earthquake Hazard Reduction Program has funded research to develop stronger code provisions for seismic safety in new and existing buildings. It has also provided modest funding for state seismic safety offices, education and outreach programs, and some key partnerships with the private sector. Relatively little attention has been given to measures to promote local enforcement of compliance with the seismic provisions of building codes. Recognizing the gaps in state adoption and local enforcement of codes with seismic provisions, the Federal Emergency Management Agency funded the development of a guide to code adoption and enforcement and is promoting its use by state officials (Olshansky 1998).

2.3 STUDY DATA AND METHODS

To characterize state building code and energy programs, we examined relevant state legislation and rules, and we conducted a mail survey in 1995 of state officials responsible for building regulation and energy programs. Responses were obtained from each of the thirty-three states with a state building code that was not limited to special classes of buildings.

To gather information about the priority that local officials attach to enforcement of seismic safety and energy provisions of building codes, we conducted a mail survey in 1995 of local building officials in each of the fifty states. The sample frame for our survey was based on a prior national survey undertaken by the National Conference of States on Building Codes and Standards (1992) that addressed state and local capacity to enforce the seismic safety provisions of building codes. We obtained responses from 82 percent of the officials contacted, which provided a nationwide sample of 819 respondents. In order to provide a profile that is representative of the distribution of local governments in the United States, we weighted the sample data in our analyses to reflect each state's proportion of the total number of local governments in the United States.

The priority officials assign to enforcement of the basic structural provisions of the building code serves as a point of comparison for these analyses. Because the risk posed by earthquakes varies nationwide, we disaggregate the results in terms of three categories of earthquake hazard. Any such designation is problematic given the variation in local soil conditions and characteristics of events, but we account for these variations by distinguishing between localities according to the expected seismic forces (Peak Ground Acceleration or PGA) that are to be experienced as shown by maps produced for the National Earthquake Hazard Reduction Program. We designate low-hazard jurisdictions as those for which the forces are expected to result in limited damage even to older buildings (PGA less than 10 percent of gravity). Intermediate-hazard jurisdictions are those for which damage to older buildings is likely (PGA between 10 and 20 percent of gravity). High hazard areas are those for which more extensive damage is likely (PGA greater than 20 percent of gravity).

We consider the role of different aspects of state building code and energy programs in shaping the priority that local officials give to enforcing energy-efficiency and seismic-related provisions of building codes. The state choices that we examine include the degree of prescription and oversight of local code enforcement, the capacity of the state building code agency, and provision of technical training for local government building code personnel. State energy policy choices include the establishment and maintenance of a state energy department and the delivery to local governments of training materials and other assistance for enforcement of the energy provisions of the state code.

2.4 ANALYZING VARIATION IN LOCAL ENFORCEMENT PRIORITIES

In the analyses that follow, we first examine the priority that local building officials give to enforcing energy-efficiency and seismic-related code provisions for the national sample of local jurisdictions. We then turn to consideration of the role of state programs in motivating local enforcement of different code provisions. The multivariate analyses that follow provide a basis for examining the relative impacts of different aspects of state programs and the role of various local demands and pressures in influencing local priorities for the enforcement of building codes.

2.4.1 Enforcement Priorities of Local Governments

The priorities that local officials attach to the enforcement of different code provisions are shown in Table 2.1. On a scale of 1 (low) to 5 (high), two-thirds of local building officials report that they give high priority (score of 5) to enforcement of the structural provisions of the building code. In contrast, only 17 percent and 16 percent, respectively, give high priority to the seismic safety and energy provisions of the code. On average, the priority assigned to seismic provisions (score of 2.6) is below the mid-point of the scale, while the priority of energy-efficiency provisions (score of 3.0) rates only slightly better. In both cases, there is clearly variation among localities in priorities that they assign to these provisions, which suggests that potential weaknesses in enforcement and code violations go undetected.[4]

Table 2.1 Local Government Priorities for Enforcing Different Building Code Provisions

	Percent of Building Officials Who Assigned a Given Priority Rating to Enforcement of Different Building Code Provisions[b]		
Priority Scores[a]	Structural Provisions	Energy-Efficiency Provisions	Seismic-Hazard Provisions
Low - 1	2	14	35
2	2	19	16
3	6	33	17
4	23	18	15
High - 5	66	16	17
Mean score	4.5	3.0	2.6
Median score	5.0	3.0	2.0
Number of localities[c]	811	734	619

Notes:

[a] Question: Consider the following provisions of the building code you enforce. For each set of provisions, please give us your assessment of the current priority given to these provisions by the building department. (If the code you enforce does not contain the provisions, circle not applicable.)

[b] Distributions are based on weighted sample data in order to reflect the proportion of localities among the states. The total percentage for structural provisions is less than 100 because of rounding.

[c] The total sample size is 819. The large number of missing cases for priority assigned to the energy-efficiency (85 cases) and seismic-safety (200 cases) provisions is due to the report by a number of officials that a rating of priority is not applicable because the building code they enforce does not contain those provisions.

The low priority that localities place on seismic provisions is due, in part, to the fact that earthquake hazards are very unevenly distributed across the United States. Table 2.2 shows the variation in priority for enforcement of seismic provisions among localities with different degrees of seismic hazard. Where seismic hazard is high, a large proportion (57 percent) of local officials reports giving high priority to the enforcement of seismic provisions of codes. These include a majority of the jurisdictions in our sample from Alaska, California, Nevada, Utah, and Washington. Among this group, only 21 percent assign enforcement of seismic provisions mid-level or low priority (3 or less on the 5-point scale of priority). The more problematic situation is the intermediate-hazard jurisdictions for which earthquakes can cause substantial damage, especially to older buildings. These include widespread areas of the New England states, South Carolina, states affected by the New Madrid fault zone (Arkansas, Illinois, Kentucky, Missouri, and Tennessee), and some western states (Arizona, Montana, Oregon, and Wyoming). Only 22 percent of the building officials in these states report that seismic provisions are a high priority (rating of 5) while 57 percent rate them as a mid-level or low priority (3 or less on the 5-point scale). In states with low seismic risk, nearly 90 percent of local officials rate enforcement of seismic provisions as a mid-level or low priority.

Table 2.2 Earthquake Hazards and Priorities for Enforcement of Seismic Code Provisions

	Percentage of Building Officials Assigning a Given Priority Score for Seismic Enforcement by Degree of Hazard[b]		
Priority Scores[a]	High Hazard	Intermediate Hazard	Low Hazard
Low - 1	9	21	55
2	5	12	21
3	7	24	13
4	22	21	8
High - 5	57	22	4
Mean Score	4.1	3.1	1.9
Median Score	5.0	3.0	1.0
Number of Localities[c]	58	270	282

Notes:

[a] Question: Consider the following provisions of the building code you enforce. For each set of provisions, please give us your assessment of the current priority given to these provisions by the building department. (If the code you enforce does not contain the provisions, circle not applicable.)

[b] Localities are classified according to the expected ground motion (Peak Ground Acceleration) associated with seismic events as shown by maps produced for the National Earthquake Hazard Reduction Program, 1988 provisions. See text for definitions of the categories. Distributions are based on weighted sample data in order to reflect the proportion of localities among the states. The percentages of low seismic hazard are greater than 100 because of rounding.

[c] Weighted sample sizes based on a total sample of 619 localities enforcing codes with seismic provisions.

2.4.2 Impacts of State Code Enforcement Programs

We noted earlier the presumed importance of state requirements for adoption of codes by local governments and of state efforts to assist local governments to increase their ability to enforce codes. We also expect there to be differences in outcomes with respect to energy-efficiency and seismic-related code provisions given the emphasis that the federal government has placed on state adoption and enforcement of energy-efficiency provisions.

Table 2.3 shows the role that different aspects of state programs have in shaping local code enforcement efforts for energy-efficiency and seismic provisions of codes. Because of the importance of the extent of seismic hazard in affecting the priority that is assigned to seismic provisions, we provide separate comparisons for different levels of seismic hazard. The table entries show the mean priority scores for local governmental enforcement efforts when grouped according to differences in state approaches to enforcement and differences in state assistance provided to local governments. We report statistical tests of the differences of means (one way analysis of variance) for the various entries in order to depict the variability in the data.

Table 2.3 State Influence on Enforcement Priorities of Local Building Departments

	Priority Given by Local Officials to Specified Provisions of Building Codes[a]			
Characteristics of State Building Code Program	Energy Efficiency Provisions	Seismic Safety Provisions[b]		
		High Hazard	Intermediate Hazard	Low Hazard
State Approach to Enforcement[c]				
Minimalist	2.4	3.6	3.2	1.4
Enabling	3.1	3.8	2.4	1.8
Mandatory	3.6	4.7	3.3	1.8
Energetic	3.5	4.5	3.0	2.4
Statistical significance of difference in means	(p < .001)	(p = .04)	(p = .05)	(p < .001)
Staff Training (general)				
None received from state	2.5	3.5	3.1	1.6
Staff received training from state	3.4	4.6	3.1	2.0
Statistical significance of difference in means	(p < .001)	(p < .001)	(p = .87)	(p < .001)
Staff Training or Financial Assistance with Energy Provisions				
None received	2.8	---[d]	---	---
Received Training or assistance	3.6	---	---	---
Statistical significance of difference in means	(p < .001)	---	---	---
Number of Localities	734	58	270	282

Notes:

[a] Cell entries are mean values of priorities stated by building officials on a scale of 1 (low) to 5 (high). Values are based on weighted sample data in order to reflect the proportion of localities among the states. Statistical significance tests are F-tests for the difference of means.

[b] Localities are classified according to the expected ground motion (Peak Ground Acceleration) associated with seismic events as shown by maps produced for the National Earthquake Hazard Reduction Program, 1988 provisions. See text for definitions of the categories.

[c] Minimalist states leave local adoption and enforcement of the building code wholly to the discretion of local governments. Enabling states have established a state building code, but whether local governments enforce the code is left to local discretion. Mandatory states have adopted a state building code and require local adoption and enforcement of the code, but they exert little effort in enforcing local government compliance with this requirement. Energetic states have adopted a state building code, require its enforcement by local governments, and have programs in place to ensure that local governments comply with these directives.

[d] Rating not applicable because the state actions only apply to energy provisions.

The differences between the effects of state programs on local governmental priorities for energy and seismic provisions are striking. The approach of states to local adoption and enforcement of building codes has a marked effect on the attention that local governments give to enforcing the energy provisions of the codes. When states mandate local adoption and enforcement of the state code (mandatory and energetic states), localities give energy efficiency a much higher degree of attention than they do in states that have left code enforcement to local discretion (enabling and minimalist states). At the time of our data collection, all but one of the states that mandated a state building code also mandated a state energy code (see May et al. 1995). However, the degree of state oversight of local code enforcement (which differentiates energetic from mandatory states) seems to have little effect on local priorities. This may be because state oversight does not emphasize energy provisions.

The state approach has a pronounced effect on the priority assigned to seismic provisions only for localities in areas with a high degree of seismic hazard. For these, state requirements for local adoption and enforcement of codes increases the priority for seismic provisions on average from the 70^{th} to the 95^{th} percentile of all localities. For states with an intermediate degree of seismic hazard, the state role makes no statistical difference in influencing the priority of local governments for enforcing seismic provisions of building codes. For those states with a low degree of seismic hazard, only the strong state oversight that is characteristic of energetic states successfully moves seismic issues beyond the lowest levels of our scale of priority. Yet these jurisdictions only fall on average at the 50^{th} percentile of all jurisdictions in the priority for enforcement of seismic code provisions.

The different influence of state approaches among hazard levels can be explained from both a state and a local perspective. The relevant officials in states that mandate local enforcement of code provisions (mandatory and energetic states) are more likely to pay attention to seismic provisions of codes when the earthquake hazard is high. When the hazard is lower, state officials are less likely to focus on that issue and are more likely to address other issues of concern, such as energy efficiency. From the perspective of local officials, the degree of hazard serves as a basis for priming them to be more or less attentive to seismic code provisions. As the extent of hazard increases, local building officials are more likely to seek out relevant information from state officials regardless of the state role. This is evidenced by the fact that the enforcement priority that local officials give to seismic provisions increases on average across all categories of state roles according to the level of the earthquake hazard. The somewhat anomalous impact of energetic state roles in promoting higher priorities among jurisdictions with low hazards might be explained by the role of state oversight in overcoming a minimal threshold to place earthquake hazards on their agenda.

Important components of state roles are training and other assistance provided to local governments. Table 2.3 shows the effects of staff training in general (not distinguishing particular code provisions) and of training or assistance that is specific to energy code provisions. (We do not have information specific to seismic provisions.) Again, there are differences between the effects of training on the priority assigned to energy and to seismic-related provisions. Staff training, whether general or specific to energy provisions, increases the priority of energy-related provisions on average from the 40^{th} to the 70^{th} percentile of all jurisdictions. With respect to seismic provisions, staff training follows a similar pattern to the influence of state approaches to enforcement. There is a marked effect of staff training in drawing attention to seismic provisions among high-hazard localities, no difference among intermediate-hazard localities, and a smaller difference among low-hazard localities.

2.4.3 Examining Relative Impacts of Different Actions

The results so far tell us that state requirements and actions do indeed make a difference in drawing local attention to code provisions, but attention to seismic considerations also depends on the seriousness of the problem. A final step in our analysis is to consider the relative impacts of various state and local governmental actions in affecting code priorities. Our earlier discussion leads us to think about the impacts of state governmental actions, while also taking into account differences among local code enforcement programs in general and among different local settings. These additional factors merit discussion before turning to the results of our multivariate analyses.

Our research on enforcement of building codes (Burby et al. 1998b) shows that more is involved in shaping local code enforcement than state mandates to enforce codes. Indeed, we show that essential factors are high degrees of agency commitment and capacity that entail necessary resources and expertise for carrying out complicated tasks of code enforcement. These capabilities are in turn affected by the level of community demands and pressures for and against code enforcement. These are directly reflected by the stance of affected interests (builders, developers, and related groups) and indirectly reflected by such indicators as growth rates, population, and the value of housing. Also relevant, as the preceding findings suggest, is the extent of the problem.

Our expectations about the role of these factors in shaping enforcement priorities can be summarized as follows. We expect that energy-efficiency and seismic-related code provisions will receive greater priority from local officials (1) when localities have proactive building code enforcement systems (i.e., expend greater effort and have greater capacity for enforcement); (2) when resources are more plentiful (larger population, higher growth, higher value housing); (3) when opposition to code enforcement is lower; and (4) when energy consumption and seismic risk are more serious (higher energy consumption per capita, greater seismic risk, and experience with previous earthquake damage).

Table 2.4 presents the results of our multivariate analyses of the variation in priority that local building officials attach to energy-efficiency and seismic provisions of building codes. We restrict our analysis of seismic-provisions to localities with intermediate to high seismic hazards in order to provide a meaningful comparison. Of interest are the relative effects of state approaches and program provisions, shown in the upper part of the table, on these priorities. We also take into account the differences in local code enforcement programs and context discussed in the preceding paragraphs. The cell entries of the table are the standardized coefficients from regression models estimated using Ordinary Least Squares estimation. Because the coefficients are standardized, they can be used as a gage of the relative importance of different factors, while keeping in mind differences in levels of statistical significance.

The results for the priorities assigned to enforcement of energy-efficiency provisions are consistent with the basic comparisons discussed so far. The multivariate results show that both a proactive state approach to local governments (mandatory or energetic state roles) and the provision of training and financial assistance programs to increase local government capacity lead to greater priority for enforcing energy-efficiency provisions. The state approach works to increase local governmental *commitment* to enforce energy provisions of building codes. Training and financial assistance programs work to increase local government *capacity* for enforcing these provisions. The important finding is that both a proactive state approach to local governments *and* capacity-building programs are important with a proactive state role having somewhat more influence (reflected by a larger coefficient).

Table 2.4 Factors Influencing Enforcement of Seismic and Energy-Efficiency Provisions of Building Codes

	Regression Models for Variation Among Localities in Priority for Code Provisions[a]	
Explanatory Variables	Energy Provisions	Seismic Provisions[b]
State Building Code Program Characteristics:		
Proactive state approach[c]	.22***	.04
Training provided by state about codes	.15***	-.02
State Energy Policy Actions		
Energy agency established by the state	.09**	---
Energy code training or other assistance provided	.16***	---
Local Code Enforcement Program Characteristics		
Code enforcement effort[d]	.17***	.11**
Capacity to enforce code[e]	.21***	.23***
Local Demands and Pressures		
Population in 1990 (natural log)	-.06*	.11**
Population growth, 1980-89	-.04	.09**
Median value of housing 1990 (natural log)	.03	-.13**
Political opposition to enforcement[f]	-.04	-.03
Problem Characteristics		
Energy consumption per capita (state level 1991)	-.11**	---
Seismic hazard[g]	---	.25***
Presidential declaration of earthquake disaster within the last decade	---	.03
Adjusted R^2	.34	.16
Significance	$p < .001$	$p < .001$
Number of localities	662	289

Notes:

* p < .05 ** p < .01 *** p < .001 (one-tailed test)

[a] Cell entries are standardized regression coefficients for which the dependent variable is the priority stated by building officials on a scale of 1 (low) to 5 (high). Regressions are based on weighted sample data in order to reflect the proportion of localities among the states.

[b] Sample restricted to localities that are classified as having intermediate or high seismic hazards.

[c] States with mandatory or energetic approaches to code enforcement.

[d] Index of overall effort a locality makes for code enforcement that is not specific to seismic or energy provisions. Mean of respondent rating (scale 0 to 100) of degree of effort expended by the agency on seven tasks: public relations, surveillance, plan checking, inspection, legal prosecution, technical assistance, public awareness.

[e] Index of overall capacity of a locality to enforce codes that is not specific to seismic or energy provisions. Mean of respondent rating (each on scale of 1, poor to 5, good) of four items: adequacy of non-personnel budget, adequacy of staffing, agency technical expertise, authority for enforcing codes.

[f] Index of opposition by key groups to stronger code enforcement. Percentage (0 - 100) of seven groups that actively advocate reduced code enforcement: architects'/engineers' groups; Chamber of Commerce; Environmental groups; General Contractors Association; Historic preservation groups; Homebuilders Association; Neighborhood groups [Sq. root transformation used in statistical analyses.]

[g] Expected ground motion (Peak Ground Acceleration) associated with seismic events as shown by maps produced for the National Earthquake Hazard Reduction Program, 1988 provisions.

The striking contrast is the limited impact of state programs on the priority that local officials in intermediate- to high-hazard localities assign to seismic provisions. When taking into account different local contexts and programs, we fail to detect statistically significant effects of state programs. There may be differences for high hazard localities, but the limited variability in the data and in key factors that are used as controls prohibit such an analysis. The results for the state program suggest important differences in the way that energy and seismic provisions are addressed as part of state programs. We argue that these differences are a consequence of differences in the federal approach that has been aggressive and well-financed for energy-efficiency provisions while it has been more passive and less well-financed for promoting enforcement of seismic provisions of codes.

The multivariate results also provide insights about the influence of different characteristics of local building departments on priorities for enforcement of energy-efficiency and seismic provisions. Both receive higher priority from building officials when local building departments have greater general capacity to enforce building codes and when they exert more effort on code enforcement tasks such as plan checking, inspections, technical assistance, prosecution of violators, and public awareness. It is important to note that our measures of effort and capacity are not specific to energy or seismic provisions and thus these relationships are not simply a result of higher priorities given to energy-efficiency or seismic provisions. As noted above, our previous research (Burby et al. 1998b) suggests that the characteristics of local code enforcement facilitate increased attention to specific code provisions. Indeed, as indicated by the magnitude of the coefficient, the capacity of the local building enforcement agency is the single most important factor other than seismic hazard itself in influencing the priority assigned to enforcing the seismic provisions of codes.

Local demands and pressures have little discernible effect on the priorities assigned to energy-efficiency provisions. However, these factors influence the priorities assigned to seismic provisions. Because these are indirect measures of demands and resources, explanations for their influences are necessarily speculative. The positive influence of population size might be characterized as reflecting sources of demand resulting from increased risk associated with larger populations. Population growth might foster demands for seismic provisions associated with increased levels of new construction for which seismic provisions of codes are applicable. The negative influence of higher valued homes may reflect the greater vulnerability to earthquakes of communities with older, lower-priced housing stock for which the seismic risk is much more difficult to address than with new construction.

As expected, the degree of earthquake hazard has a strong influence on the priority that local officials attach to enforcement of seismic provisions of building codes. Indeed, as indicated by the magnitude of the coefficient, it has the strongest influence of any of the factors considered. The influence of whether a locality had experienced property damage from an earthquake in the past decade or not is confounded by including seismic hazard in the regression model. When seismic hazard is excluded, previous damage, as expected, has a positive influence on the priority assigned to earthquake provisions (Beta = .13, p = .02).

It is interesting to note that the amount of energy use does not have a similar effect upon the priority given to enforcing code provisions relating to energy efficiency. In fact, localities in states with lower, rather than higher, energy consumption per capita give higher priority to these tasks. This may be due to two factors. First, energy consumption has received relatively little media attention since the energy crisis of the early 1970s, while seismic risk periodically is reinforced through the occurrence of large earthquakes. Second, this may reflect the success of states with high levels of energy use in reducing consumption per capita over the past two decades.

2.5 CONCLUSIONS AND POLICY IMPLICATIONS

Despite a reputation for exemplary building practices in the United States, this research documents shortfalls in municipal enforcement of the seismic provisions of building codes. The good news is that enforcement of the seismic provisions of codes is generally a high priority among local governments within areas subject to high levels of seismic hazards. The bad news is that enforcement of these measures receives much lower priority in many areas of the country where seismic hazards are more moderate but still capable of inflicting substantial damage. Our research provides a basis for suggesting ways in which building codes can be made a more effective tool for earthquake hazard mitigation.

One set of findings from this research is the striking difference between the strong role of states in influencing local priorities for enforcing energy-efficiency provisions of codes and the lesser role of states in influencing priorities for enforcing seismic provisions of codes. These differences can in turn be traced to the substantial disparity between federal energy-efficiency and seismic safety programs. The federal government has paid much greater attention to inducing the states to attend to energy efficiency than it has to seismic safety. As a result, many states have adopted state energy codes and have become active in their implementation. In turn, these efforts have resulted in greater local governmental attention to the energy-efficiency provisions of the state codes. The federal seismic safety effort through the National Earthquake Hazard Reduction Program has not had the same effect on state adoption of seismic-related provisions or on state actions to promote local enforcement of these provisions.

This does not mean that federal efforts to strengthen seismic code provisions have been wholly ineffective. The federal efforts have been instrumental in pushing some states, particularly those with higher degrees of seismic hazards, to adopt relevant code provisions and to require their enforcement by local governments. But, our research suggests that the current national effort in this regard is too small to have a discernible impact on the priorities that local officials in many parts of the country attach to seismic hazards. In contrast, the federal effort to foster the adoption and enforcement of code provisions concerning energy efficiency has had a marked effect on the priority that local officials attach to that function throughout the country.

A second set of findings from this research relates to the differences in demands for increased attention to different aspects of building codes. On the one hand, local governmental energy-efficiency priorities appear to be driven mostly by demands from state and federal programs and not by local demands and pressures. This suggests that building officials see emphasis on energy efficiency less as a response to a pressing local problem and more as something that is demanded both from above by state requirements and that is generally expected by citizens. On the other hand, seismic priorities appear to be driven mostly by local demands and pressures and not by state or federal actions. This means that seismic considerations are less institutionalized as a means of doing business and more subject to the vagaries of local resources and pressures. As a consequence, we find more variation in priorities for enforcing seismic provisions than for enforcing energy-efficiency provisions of codes.

Several policy implications can be derived from this research. One is the positive role that the federal government can potentially play in advancing state and local efforts to adopt and enforce seismic provisions of building codes. Clearly, such a federal role is not easy to bring about in the present era of limitations on new federal mandates. Substantial federal financial and technical support for energy efficiency in the built environment came about in the wake of a serious national crisis that attracted the attention of virtually every citizen. A similar crisis atmosphere has yet to develop for seismic hazards in the United States, although it might materialize in the aftermath of another catastrophic earthquake. Recent damaging events in southern California with the Northridge earthquake in 1994 and in northern California with the Loma Prieta earthquake in 1989 have increased the attention paid to earthquake risks, but these events also add to the perception of earthquakes in the United States as a "California problem." A damaging earthquake in a geographic area where perceptions of earthquake risks are lower but the actual risk is still substantial may provoke a wider sense of a national crisis. These areas in the United States include the Pacific Northwest, the New Madrid fault zone in the Midwest, the New England states, and parts of South Carolina.

The federal government could influence state and local seismic safety efforts through a variety of means. Adoption of a state building code with seismic provisions could be a condition for receiving disaster assistance or other forms of federal funding. In addition, eligibility requirements for federal aid could specify that the states mandate, not just encourage local governmental enforcement of the seismic provisions of building codes. In this effort, the federal government could target participation of those states that are located in areas of moderate to high seismic risk that have weak state building code programs or lack a building code. In states with moderate to high seismic risk that already have in place strong code programs, we foresee few obstacles to the states taking advantage of additional federal technical and financial assistance to enable them to increase local enforcement of seismic code provisions.

A second implication of our research has to do with the commitment of local governments to enforce building codes in general and seismic provisions in particular. Our research shows that any initiative that improves the commitment of local governments to code enforcement will lead to greater efforts to promote seismic safety. The most notable recent initiative in this regard is the insurance industry’s program, administered by the Insurance Services Organization, to offer insurance rate reductions as an inducement to strengthen the code enforcement function in local government. In addition, the Institute for Business and Home Safety (IBHS) has mounted a sustained effort to make the insurance industry and government officials more aware of the importance of local code enforcement in curbing the rate of increase in insured losses from natural disasters (see, for example, IBHS 1993). These concerns are also part of the current Project Impact program of the Federal Emergency Management Agency.

Under this program, over 100 communities have been selected to date to demonstrate the benefits of local efforts to promote hazard mitigation (Federal Emergency Management Agency 1998). While each of these is a sensible undertaking, the implication of the experience with energy programs is that a much larger effort is required to have nationwide impacts.

The final lesson we draw is the importance of education, training, and grants-in-aid that are targeted to local governments and specific to enforcement of particular code provisions. These are critical for raising the commitment and capacity of local personnel to enforce seismic and other code provisions. Training and education have been a central component of the federal effort to improve energy efficiency, for which our data clearly show that such assistance has had a positive impact in increasing attention to energy-efficiency code provisions.

Although much remains to be learned about how to foster local commitment to hazard mitigation, this study provides evidence from experience with energy provisions of building codes that can be applied to seismic and other provisions of building codes. There are clearly differences in the nature of the problem, demands for action, and ability to demonstrate positive benefits that are relevant factors in shaping decision-making about different code provisions. However, the broader lessons from this research concern the role of higher-level governments in motivating local governments to address risks posed by natural hazards. Although the lessons we draw are specific to the United States, the more general intergovernmental issues and lessons potentially apply to other countries with multi-tiered governmental structures.

Chapter 2 Notes

1. May's data are based on conditions in 1995. The states without a state code at that time, which May (1997) terms a "minimalist" approach to building codes, are: Alabama, Arizona, Colorado, Delaware, Hawaii, Illinois, Kansas, Maine, Missouri, Mississippi, North Dakota, New Hampshire, Oklahoma, Pennsylvania, South Carolina, South Dakota, and Texas.
2. The following states comprised these categories (as of 1995). "Enabling" states included Arkansas, Georgia, Idaho, Iowa, Louisiana, Minnesota, Nebraska, and West Virginia. "Mandatory" states included California, Florida, Indiana, Massachusetts, Maryland, New Mexico, Nevada, Rhode Island, Utah, Virginia, Washington, Wisconsin, and Wyoming. "Energetic" states included Alaska, Connecticut, Kentucky, Michigan, Montana, North Carolina, New Jersey, New York, Ohio, Oregon, Tennessee, and Vermont.
3. For more detailed descriptions of energy efficiency programs and an assessment of their potential to serve as models for programs to foster the mitigation of natural hazards, see McMillan and Burby (1998), May et al. (1998), and May and Bolton (1991).
4. This situation is also indicated by the relatively large number of local building officials (10 percent for energy provisions and 24 percent for seismic provisions) who reported that the code they enforced did not contain provisions related to energy efficiency or seismic safety.

Chapter 2 References

Advisory Commission on Intergovernmental Relations. 1966. *Building Codes: A program for intergovernmental reform*. Report A-28. Washington, D.C.: ACIR.

Burby, Raymond J., Steven P. French, and Arthur C. Nelson. 1998a. Plans, code Enforcement, and damage Reduction: Evidence from the Northridge Earthquake. *Earthquake Spectra* 14(1)(February): 59–74.

Burby, Raymond J., Peter J. May, and Robert Paterson. 1998b. Improving compliance with regulations: Choices and outcomes for local government. *Journal of the American Planning Association* 64(3) (summer): 324–34.

California Seismic Safety Commission. 1995. *Northridge earthquake: Turning loss to gain, Seismic Safety Commission report to Governor Pete Wilson.* Report SSC 95-01. Sacramento, Calif.: The Commission.

Federal Emergency Management Agency. 1998. Project impact: building a disaster resistant community. Press release 1 June. Washington, D.C.: Washington, D. C.: Federal Emergency Management Agency.

Insurance Institute for Property Loss Reduction. 1995. *Coastal exposure and community protection: Hurricane Andrew's legacy*. Boston: Insurance Institute for Property Loss Reduction.

Institute for Business and Home Safety. 1993. *Building Codes: Defining the insurance industry role*. Boston: IBHS.

May, Peter J. 1997. State regulatory roles: Choices in the regulation of building safety. *State and Local Government Review* 29(2): 70–80.

May, Peter J., and Patricia Bolton. 1991. Assessing floodproof retrofitting implementation prospects: Implications of energy conservation efforts. In *Floodproof retrofitting: Homeowner self-protective behavior.* Monograph no. 49. Shirley Laska, ed. Boulder, Colo.: Institute of Behavioral Science, University of Colorado.

May, Peter J., Dan Hansen, and Mark Donovan. September 1995. State building and energy code administration: Report to respondents to a national survey of state agencies. Seattle, Wash: Department of Political Science, University of Washington, May, Peter, Raymond J. Burby, and Howard Kunreuther. 1998. Policy design for earthquake hazard mitigation: Lessons from energy conservation, radon reduction, and termite control. *Earthquake Spectra* 14(4): 629–50.

McMillan, Sandra C., and Raymond J. Burby. July 1998. Energy efficiency programs as a model for policy to promote hazard mitigation in single family residential buildings. DURPS working paper no. 53. New Orleans, La.: College of Urban and Public Affairs, University of New Orleans.

National Commission on Urban Problems. 1968. *Local land and building regulation: How many agencies? What practices? How much personnel?* Research report no. 6. Washington, D.C.: Government Printing Office.

National Conference of States on Building Codes and Standards (NCSBCS). May 1992. *Seismic provisions of state and local building codes and their enforcement*. Washington, D.C.: National Institute of Standards and Technology, U.S. Department of Commerce.

Olshansky, Robert B. 1998. *Promoting the adoption and enforcement of seismic building codes: A guidebook for state earthquake and mitigation managers*. FEMA 313. Washington, D.C.: Federal Emergency Management Agency.

Sioshansi, Fereidoon P. 1994. Restraining energy demand: The stick, the carrot, or the market? *Energy Policy* 22(5): 378–92.

Smith, Loretta A., and Steven Nadel. 1995. *Energy code compliance*. Washington, D.C.: American Council for an Energy-Efficient Economy.

Southern Building Code Congress International, Inc. 1992. *Coastal building department survey*. Chicago: Natural Disaster Loss Reduction Committee, National Committee on Property Insurance.

Turchen, Stephen, and Craig Conner. 1996. Making sense of the model energy code. *Home Energy* 13(2): 21–25.

U.S. Department of Energy, Building Standards and Guidelines Program. 1997a. *About the model energy code*. Washington, D.C.: U.S. Department of Energy, at http://www.energycodes.org.

U.S. Department of Energy. 1997b. *Rebuilding your home sustainably*. Washington, D.C.: U.S. Department of Energy at http://www.sustainable.doe.gov

3 Regulatory Backwaters: Earthquake Risk-Reduction in the Western United States

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3.1 INTRODUCTION

Much of the attention in the study of state and local regulation has focused on salient issues like the adequacy of facilities for childcare, quality of nursing homes, and consumer fraud. These are common concerns of many citizens for which state and increasingly local governments have had visible and often contentious regulatory roles. These issues attract media attention when scandals or crises arise. That attention helps to mobilize citizens who demand redress from their elected officials. Because of these demands, such issues virtually necessitate new regulations or tougher enforcement of existing rules.

Not all issues that require state or local regulatory responses have this degree of salience. Among a long list of less prominent tasks, we tend to take for granted the role of state and local governments in protecting property and citizens from the harmful effects of earthquakes. This role takes on special significance in geographic areas with moderate to high degrees of earthquake risks. We are reminded of these risks from time to time while watching television scenes of earthquake damage. However, for many people these are isolated and remote circumstances that are quickly forgotten.

This regulatory function takes place in the backwaters of state and local government. As such, it entails different regulatory politics and challenges than those addressing more prominent and immediate problems. William Gormley (1986) has aptly contrasted the visible and contentious politics associated with salient issues with the less visible and more mundane politics of less-salient issues. In addition to these differences, the lack of sustained public demands and attention for less-salient issues has consequences in terms of more limited willingness of politicians to devote resources and attention to these problems. This is especially true when the need for intervention seems remote or the required actions are costly, as are the case for earthquake risks.

We address regulation of earthquake risks within the western United States as an illustration of regulatory challenges involving less salient issues. As elaborated upon in what follows, the risks posed by earthquakes are noteworthy but not uniform for the western United States. The available evidence suggests varying concerns among residents, with the typical view suggesting a good deal of fatalism in the perception of risk. Given this, there is variation in the extent of state and local efforts to reduce seismic risks either through various land-use regulations or through enforcement of seismic-related provisions of building codes.

Our interest is in understanding the influence of state mandates and of local political and economic factors in prompting local governments to adopt and enforce regulations concerning seismic risks. To get at these issues, we analyze data concerning local regulatory efforts for a sample of 258 local governments in 11 western states. We study western states because they have the highest seismic risk in the country and because each has adopted the same basic set of code provisions governing the regulation of buildings (the Uniform Building Code). We show that the variation in the local governmental efforts to promote risk reduction is not solely a function of differences in earthquake risks or experience with damaging earthquakes. State mandates play an important role in fostering adoption of regulatory measures by local governments, while different local demands and resources affect the efforts that local governments expend on various enforcement tasks.

In what follows, we first elaborate upon the key regulatory challenges posed by earthquake risks in the western United States, the state responses to those challenges, and factors that potentially constrain local regulatory responses. After discussing data we have collected for the sample of local governments, we describe and analyze variation in the adoption and enforcement of risk-reduction measures. This provides a basis for observations about the role of mandates and other factors in shaping local efforts to reduce earthquake risks.

3.2 REGULATORY CHALLENGES FOR EARTHQUAKE RISKS

All or parts of 39 states lie in regions classified as having potentially damaging earthquake hazards for which more notable hazards exist in the 13 western states, in the seven central states surrounding the New Madrid earthquake zone, and parts of South Carolina (see Page et al. 1992). Among the western states including Hawaii and Alaska, 52 million people are exposed to seismic hazards that include potential for extreme ground shaking, surface faulting, ground failures, and earthquake-induced tsunamis. Devastating earthquakes in the San Francisco area in 1989 and in Los Angeles area in 1994 serve as important reminders of earthquake risks in California, but noteworthy damage has also been experienced this decade in each of the western states. In this century, there have been 148 "strong" to "great" earthquakes of Richter magnitude greater than 6.0 in the western United States not including Alaska (Comerio 1998: 11).

Despite the risks posed by earthquakes and the experience with them in this region, there is not much of a public constituency pushing for efforts to avert earthquake losses. As discussed by Peter May (1991), this is not because of lack of public awareness of the risks posed by moderate to high degrees of earthquake hazards. In reviewing a number of studies, May showed that the awareness of risks posed by earthquakes is generally high but the willingness of homeowners to take action is dramatically lower. In more recent research, Risa Palm (1995) studied perceptions of earthquake risks among the residents of four California counties including two that were impacted by the 1989 San Francisco area earthquake. Seventy-six percent of the residents estimated there is at least a 1 in 10 probability of a damaging earthquake affecting their community in the next ten years, but relatively few homeowners had taken important precautionary steps to prevent damage. Fewer than 25 percent had their houses bolted to the foundation and less than 10 percent had strengthened exterior walls. Many of the homeowners preferred to take a more convenient route of purchasing earthquake insurance, which Palm estimated 50 percent of homeowners in the study areas had purchased by 1993. (The increased demand for earthquake insurance coverage helped to precipitate a minor insurance crisis in California.)

Reflecting these fatalistic attitudes and the infrequency of damaging events, organized public demand for governmental action in reducing earthquake risks appears to be rare and short lived. Earthquake risks are not mass public issues for which groups can be found on the steps of state capitols or at city halls demanding to be saved from the next earthquake. The lack of a public constituency, coupled with limited concerns of local officials about earthquake risks, creates minimal incentives for local governments to address earthquake risks. Left to their own devices, relatively few communities subject to earthquake risks would be expected to initiate stringent risk-reduction efforts. This expectation has been borne out in studies by Berke and Beatley (1992) of planning for earthquakes in California, by Burby and Dalton (1994) in a nationwide study of local adoption of development restrictions for hazardous areas, and by May and Birkland (1994) in studying local regulatory efforts concerning seismic hazards in California and Washington.

This presents a fundamental dilemma. On the one hand, state governments and the federal government that together pay most of the bill for disaster relief have a strong incentive to reduce earthquake risks, if only to lessen the eventual earthquake-related disaster bill. On the other hand, the federal government has not had a strong regulatory role and state officials are reluctant to intervene by creating new mandates when not pressed to do so. Given the lack of public constituency demanding action, local officials are likely to only be half-hearted implementers of any state requirements. This basic dilemma is at the heart of our analysis of state and local efforts to reduce earthquake risks. It calls attention to variation in state requirements of local governments and to the different responses of local governments in adopting and enforcing risk-reduction measures.

3.2.1 State Regulatory Roles

Unlike many areas of state activity, the federal government has had limited involvement in fostering state and local regulations dealing with earthquake risks. The federal role has been restricted to funding research, funding state planning and preparedness programs, and fostering development of the technical standards for seismic provisions of building codes (see May 1991). The restricted federal involvement has left state policymakers with wide choices about the extent and form of regulation for reducing earthquake risks. Short of preventing earthquakes, which cannot be done, efforts to avert loss of life and property damage revolve around regulations governing land-use (e.g., controlling development on steep hillsides or in areas with especially vulnerable types of soils), construction of new buildings, and the rehabilitation of existing buildings.

California leads the nation in addressing earthquake risks for which a number of state mandates addressing these risks have been adopted. Seismic requirements for construction of schools, under the Field Act, were first adopted in 1933 following a major earthquake in Long Beach. Following the San Fernando earthquake in 1971, local governments were required to develop seismic safety elements as part of local comprehensive plans, new restrictions were put in place limiting construction within designated fault zones, and the presence of fault zones was required to be disclosed to potential homebuyers. More recent mandates for local governments include requirements to identify and develop programs for addressing potentially hazardous, unreinforced masonry buildings and requirements that local governments adjust comprehensive plans in accordance with a statewide program to map a range of seismic hazards. The fact that California leads the nation in addressing earthquake risks is not surprising, given both the extent of earthquake risks in the state and the occurrence of 19 major damaging earthquakes this century (Comerio 1998: 12).

California, however, is not alone among western states in adopting mandates that address earthquake risks. We classify the 11 states in our study into three categories according to state regulatory roles. The first category only contains California, the *aggressive state*, which stands alone in terms of overall risk and the extent of state mandates for local governmental action in addressing those risks. The second set is *attentive states* that have strong state building codes with required local enforcement of seismic provisions. These states have taken other steps in recent years, such as the creation of seismic safety commissions, to draw attention to earthquake risks and to foster the development of additional earthquake-related regulations. This group of states comprises Alaska, Oregon, Nevada, Utah, and Washington. The third set is *minimalist states* that have more restricted state roles in regulation of building safety that make provisions for, but do not necessarily require, local enforcement of seismic components of building codes. Unlike the other categories, these states have not created seismic safety commissions or adopted other regulations beyond those that govern state emergency management functions. This group of states comprises Arizona, Idaho, Montana, New Mexico, and Wyoming. (As noted below, we do not consider Colorado and Hawaii because we do not have enough cases for them in our sample. Colorado falls in the minimalist group and Hawaii falls in the attentive group.)

The differences in local governmental attention to the risks posed by earthquakes among these three categories of states are summarized in Table 3.1. The table shows variation in the number of regulations that local governments have adopted to foster earthquake risk reduction and in the extent to which localities place a high priority on the enforcement of seismic provisions of building codes. The variation in these measures among states generally mirrors differences in state mandates. Localities in California stand out from both the attentive and minimalist states with respect to both measures of local regulatory efforts. Localities in the attentive states have on average nearly five times as many local regulations as those of minimalist states, and nearly twice as many localities place a high priority on the enforcement of the seismic provisions of building codes than do localities in minimalist states.

Table 3.1 Regulatory Actions for Earthquake Hazards in the Western United States

	Selected Attributes for Local Governments		
Category/States[a]	**Number of Local Seismic Regulations[b]**	**High Priority for Seismic Enforcement[c]**	**Extent of Local Seismic Hazard[d]**
Aggressive State			
California (75)	*2.3*	*82.5*	*47.4*
Attentive States			
Washington (60)	1.6	60.6	24.3
Oregon (7)	1.7	29.0	22.5
Alaska (5)	1.4	61.1	21.0
Nevada (22)	1.3	50.0	20.2
Utah (29)	1.5	55.2	19.0
Mean for the group (123)	*1.6*	*50.4*	*21.8*
Minimalist States			
Montana (16)	0.5	16.7	14.3
Wyoming (5)	0.0	0.0	11.5
Idaho (12)	0.3	50.0	10.2
New Mexico (8)	0.1	28.6	6.9
Arizona (19)	0.2	27.3	6.5
Mean for the group (60)	*0.3*	*28.8*	*10.3*
Western States (258)[e]	1.3	50.8	23.7
Difference of means[f]	<.001	<.001	<.001

Notes:

[a] States classified by extent of the state regulatory role in mandating seismic risk reduction by local governments. The unweighted number of local governments in the sample are shown in parentheses. Cell entries are based on data weighted to reflect the distribution of localities in the western United States.

[b] Mean number of regulatory provisions for seismic hazards adopted by local governments out of five possible provisions. Higher values represent increased regulatory activity.

[c] Percentage of local building officials rating priority for enforcement of seismic provisions as high, based on rating the priority as 5 on a scale of 1 to 5.

[d] Mean peak ground acceleration (PGA) at 10 percent chance of exceedance over 50 years. Higher values indicate increased seismic hazards.

[e] Weighted values for all localities in the sample of the 11 western states.

[f] Significance level of F-test for difference of means, using weighted data, for the three categories of states.

The differences in local regulatory actions also reflect variation in the extent of earthquake hazards among states. The extent of the earthquake hazard is measured by the peak ground acceleration (PGA) for each area based on calculations of the United States Geological Survey (see Leyendecker et al. 1995). PGA is expressed in percentage terms relative to gravity (percent of gravity) for which higher values indicate greater earthquake hazards.[1] As a rule of thumb, values of less than 10 percent indicate limited potential for serious damage, those between 10 and 20 percent indicate potential for damage to older buildings, and greater than 20 percent indicates potential for serious damage to a range of buildings. (Note that a distinction can be made between the degree of hazard and the degree of risk for which the latter considers both the exposure of people and property and the extent of the underlying hazard.) As shown in the right column of the table, the earthquake hazard for localities differs among the three categories of states. The mean hazard for localities in California is over twice that of the mean hazard for localities in the attentive states and nearly five times that of the minimalist states.

3.2.2 Local Governmental Pressures

The preceding discussion shows that local regulatory efforts in western states for reducing earthquake risks are shaped by state requirements and by differences in earthquake hazards. However, not all localities respond in the same fashion even when taking into account the specifics of state mandates and differences in hazards. Such variation in regulatory responses is consistent with the more general findings of the literature concerning adoption and enforcement of regulations by local governments. This includes studies of the local adoption of building codes (Noam 1982), enforcement of local housing codes (Ross 1995), local enforcement of state erosion control regulations (Burby 1995), implementation by counties of North Carolina's state solid-waste mandate (Jenks 1994), local compliance with state comprehensive planning mandates in Florida (Deyle and Smith 1998) and in other states (Burby and May 1997), and local responses to state mandates for earthquake risk reduction (May and Birkland 1994).

Our interest is explaining differences in local earthquake risk-reduction efforts. Potentially relevant factors are broadly suggested by the studies noted above as well as by the more general literature on state regulation (see Teske 1994). Two sources of pressure on decision-making by local governments are evident in these studies. The state, one source, imposes mandates that dictate the extent of state assistance given to local governments in carrying out mandates, and the degree of oversight and enforcement of the intergovernmental requirements. The second set of pressures is at the local governmental level itself where officials must balance the need to act against differing political and economic considerations.

A variety of measures can be used to reduce earthquake risks for which the major actions include regulation of land use in hazardous areas (such as controls over development types and density) and regulation of buildings (such as controls on design and construction practices). Each of these imposes immediate costs such as reduced development potential and increased construction costs, while the benefits of reduced risk are often less immediate, highly uncertain, and not readily recouped through higher prices for safer buildings. Because there are few short-term political and economic incentives for local governments to address earthquake risks, state mandates are potentially important catalysts for action. Yet, as noted above, mandates differ with respect to their content, the degree to which state officials pursue them, and the willingness of local officials to implement them.

The prior research also suggests that the extent to which local governments adopt and enforce regulations is shaped by the political, economic, and problem context. In the case of earthquake risks, the political factors entail a balancing of demands to address those risks with objections to the costs imposed by the regulations. The relevant groups are those with a direct stake in the issue, which include neighborhood groups, homebuilders, and design professionals. The primary economic consideration is the wealth of a community as it affects the ability to impose regulations and the costs that they entail. The problem context is defined by the extent of the earthquake hazard, exposure of people to that hazard, and experience with damaging earthquakes.

The adoption of risk-reduction measures is insufficient in itself to bring about change since the measures also need to be implemented. The limited incentives for local governments to adopt risk-reduction measures carry forward into their implementation. Given this, some jurisdictions will only have a token compliance with state mandates by adopting the relevant measures but failing to adequately enforce them. Consistent with this expectation, Burby and Dalton (1994) found considerable variation in local regulations controlling development in hazardous areas in the United States. Similarly, Burby, May and Paterson (1998) document the variation in the extent of municipal enforcement of building codes in the United States**.** Because of the potential for notable implementation gaps, a relevant issue for this research is the extent of effort that local governments put into different aspects of implementation of risk-reduction measures.

3.3 DATA AND MEASURES

We seek to explain variation in local efforts to reduce earthquake risks with attention to the extent of adoption of various regulations, the priorities for enforcing regulations, and the effort put into implementation. We pay particular attention to the role of state mandates and of the local context in shaping local regulatory efforts. Our analysis is restricted to western states because they face the highest earthquake risk in the country and because they have adopted similar building code provisions.

3.3.1 Data

The data consist of observations for 258 local governments in 11 western states that are among those in Burby, May, and Paterson's (1998) national study of city and county enforcement of building codes. That study entailed a mail-out survey conducted in 1995 for a national sample of cities and counties having more than 2,500 population based on a sample frame constructed by the National Conference of States on Building Codes and Standards (1992). Building officials in each locality were asked to provide information about their jurisdiction's enforcement of various code provisions and about other regulations of relevance to the safety of buildings.

For this study, we selected those western states with five or more jurisdictions represented in the sample. This resulted in the elimination of Colorado and Hawaii. The response rate to the survey in the remaining western states was 76 percent, which varied from a low of 63 percent in Alaska to a high of 92 percent in Idaho. An analysis of non-response to the survey reveals that non-responding localities had substantially smaller populations on average than those for which responses were obtained (12,283 versus 88,324; t-test of differences $p < .01$). This suggests that our results slightly overstate local governmental capacity to adopt and enforce codes. In order to mirror the distribution of local governments across the states in our study, the sample data are weighted to reflect each state's proportion of the total number of localities in the western United States.

3.3.2 Measures

For the analyses that follow, we developed measures of three sets of variables: (1) the extent of local regulation and effort put into enforcement of regulations; (2) a classification of state regulation of local earthquake risk reduction, and (3) the local political, economic, and problem context. With respect to the first set of measures, there are three key aspects to local regulation. One is the extent to which local governments adopt regulations that promote reduction of earthquake risks. For this, we consider the number of regulations that a locality has adopted out of five potential regulatory actions: (1) requirements for special inspection or reports for new construction in seismic-hazard areas; (2) requirements for seismic reinforcement of existing structures; (3) requirements for securing of hot water heaters to existing structures; (4) restrictions on development in fault zones or areas with unstable soils; and (5) financial programs tied to requirements for retrofitting of earthquake-prone structures. This index of local seismic regulations has a potential range of 0 to 5, for which the mean value of the weighted sample is 1.29. Except for legislation in California that limits construction near identified fault-zones, none of these regulations was mandated by states at the time of our study.

The second aspect of local regulation is enforcement of seismic provisions of building codes. As noted earlier, California and the states that we label as attentive states each require localities to adopt and enforce the seismic provisions of the Uniform Building Code as amended by state laws. Although the minimalist states do not necessarily require adoption and enforcement of these provisions, each of the localities in our sample (as is generally true of those with larger populations) had adopted the Uniform Building Code or variants of it. But not all localities enforce the seismic provisions with equal emphasis. Given this, we employ a rating of the enforcement priority for seismic provisions as a second measure of local regulation concerning earthquake hazards. The enforcement priority is measured by the building officials' rating of the priority placed on enforcement of seismic provisions on a scale of 1 (low) to 5 (high) for which the mean value of the index for the weighted sample is 4.24. This provides a relative rating among localities in their emphasis on seismic provisions, recognizing that not all respondents interpret low or high priority in the same fashion. The moderate correlation between this measure and the seismic regulatory index of .37 ($p < .01$) gives confidence that the index of enforcement priority is a reasonably valid measure.

A third aspect of local regulation is the extent of implementation. To get at this, we rely on the respondents' reports of the degree of effort that is put into four aspects of building code enforcement, each of which is measured on a scale of 1 (low) to 5 (high). The aspects we consider are (a) effort put into the review of plans for the construction of buildings (mean 4.37), (b) field inspection of construction practices (mean 4.58), (c) legal prosecution for noncompliance (mean 2.17), and (d) efforts to build an awareness of relevant requirements (mean 3.04). Because respondents did not distinguish implementation efforts for different code provisions, none of these measures are specific to seismic provisions. Of interest is the extent to which the different aspects of the implementation effort are strengthened by stronger local earthquake risk-reduction programs and/or by higher priority for local enforcement of seismic provisions.

The classification of state mandates follows the distinction we have drawn between California, as the aggressive state, the five attentive states, and the five minimalist states. Because of the relatively small number of jurisdictions in our sample for some states, it is better to combine observations into these groupings of states rather than to look for state-specific differences. As such, our analyses include two variables that measure state-level mandate influence. One measures whether a jurisdiction is located in California. The second measures whether a jurisdiction is located in one of the attentive states.

The local political context is measured as the extent of support or opposition to strong enforcement of building codes by key groups in each community. As part of the survey, respondents were asked about the existence of seven organized interest groups in the locality and whether each advocated strong or weak code enforcement. The groups are architects or engineers' organizations, chamber of commerce, environmental groups, general contractors association, historic preservation groups, homebuilders association, and neighborhood groups. The percentage of groups advocating weak enforcement serves as a measure of political opposition (mean 23.13). The percentage of groups advocating strong enforcement serves as a measure of political support (mean 25.68). For our analysis of the extent of enforcement of building codes, we also consider the extent of politicization of the enforcement process. This is measured by whether elected officials become involved in specific cases about compliance with building codes. This occurred for 34 percent of jurisdictions in our sample.

We consider several aspects of economic conditions as proxies for the capacity of cities and counties to adopt and implement seismic regulations. Population serves as good indicator of the degree of professionalization of staff, for which larger cities have more specialized functions. However, population also reflects aspect of risk since cities with larger population by definition have greater vulnerability from a given level of earthquake hazard. Population growth over the decade from 1980 to 1990 can have counter-acting effects. On the one hand, increased growth creates demand for regulatory controls and provides resources because building departments are typically funded from fees for building permits. On the other hand, the resources often do not keep up with the demands thereby straining agency capacity to implement regulations. One additional economic factor is the wealth of a city, measured by the median value of housing. Greater wealth is presumed to enhance governmental capacity. It also increases demand for regulation since more valuable property is at risk of loss from earthquakes.

The final set of variables we consider are attributes of the extent of the earthquake problem. As discussed above, one measure of the extent of the earthquake hazard in any given location is the peak ground acceleration (PGA). We obtained values for the PGA for each locality from electronic sources of the United States Geological Survey.[2] A second indicator of the earthquake problem is whether or not a jurisdiction has experienced a damaging earthquake in recent years. We gage this from the survey respondents' reporting of whether their jurisdiction had received federal disaster assistance since 1980 for an earthquake disaster. This occurred for 11 percent of the jurisdictions in our sample, of which 85 percent were in California. (Others were in Utah and Idaho.) Disaster assistance provides a measure of both the realized risk and an indicator of the mobilization of public attention to earthquake risks in the aftermath of disasters.

3.4 EXAMINING LOCAL REGULATORY EFFORTS

Our analysis of local regulatory efforts to reduce earthquake risks entails two steps. We first consider the adoption of seismic regulations and the priorities that building departments give to the enforcement of seismic provisions of building codes. This provides an understanding of the factors shaping the attention that local governments pay to earthquake risk reduction. The second part of our analysis considers the effort that local building departments put into different code enforcement functions. This provides an understanding of the variability in implementation of these regulations.

3.4.1 Adoption and Enforcement Priority for Seismic Regulations

Table 3.2 presents our statistical findings concerning factors that influence the adoption of seismic regulations and the enforcement priority for the seismic provisions of building codes. The coefficients show the expected change (in standard units) of the number of seismic regulations and of the enforcement priority associated with each of the explanatory variables, while taking the remaining variables into account. Because the coefficients are standardized values, they can be used as a gage of the relative importance of different factors in each model keeping in mind differences in the variability of the explanatory factors. The explanatory factors account for more of the variability in local seismic regulations (43 percent) than in enforcement priority (22 percent). This is partially explained by the fact that seismic priority is high for many of the jurisdictions in the study.

Of particular interest are the relative comparisons of the influence of state regulatory provisions, political demands, economic factors, and the problem context for each of the regression models. The strength of the state regulatory program clearly makes a difference. The coefficients for aggressive and attentive state programs are relatively large (compared to other coefficients) and, except for enforcement priority in California, statistically significant at conventional levels. The state regulatory role accounts for 22 percent of the explained variation in the number of local seismic regulations and more than 7 percent of the explained variation in the enforcement priority for the seismic provisions of building codes. No statistically discernable difference is found between California and the attentive states with respect to state mandate influence on the extent of local seismic regulations. This finding is consistent with May and Birkland's (1994) finding that local government response to California's land-use planning mandates has been variable.

Table 3.2 Examining Adoption of Local Seismic Regulations

Explanatory Variables	Regression Models for Variation Among Localities (standardized coefficients): Number of Local Seismic Regulations[a]	Regression Models for Variation Among Localities (standardized coefficients): Priority of Enforcement for Seismic Provisions of Building Codes[b]
State Seismic Regulatory Program		
Aggressive State Program[c]	.35***	.14
Attentive State Program[d]	.43***	.20**
Problem Characteristics		
Seismic hazard (sq. root)[e]	.07	.31**
Prior earthquake disaster[f]	.22***	.09
Political Considerations		
Political demand for stronger code provisions (sq. root) [g]	.11*	.04
Political opposition to stronger code provisions (sq. root)[h]	.02	-.05
Economic Considerations		
Population in 1990 (natural log)	.15**	.07
Population growth, 1980-89	-.12*	-.03
Median value of housing 1990 (natural log)	.05	-.01
Adjusted R^2	.43	.22
Statistical Significance	p < .001	p < .001
Weighted Number of localities	225	218

Notes:

* p < .05 ** p < .01 *** p < .001 (one-tail test)

[a]. Number of regulatory provisions for seismic hazards adopted by local governments out of five possible provisions. Higher values represent increased regulatory activity.

[b] Building officials' rating of the priority for enforcement of seismic provisions on a scale of 1 (low) to 5 (high).

[c] Whether or not a jurisdiction is within California.

[d] Whether or not a jurisdiction is within Alaska, Nevada, Oregon, Utah, or Washington.

[e] Peak ground acceleration (PGA) at 10 percent chance of exceedance over 50 years. Higher values indicate increased seismic hazards.

[f] Whether or not a jurisdiction had been declared eligible since 1980 for federal disaster relief for earthquake damage.

[g] Percentage of key groups that advocate stronger code enforcement.

[h] Percentage of key groups that oppose stronger code enforcement.

Despite strong building codes in California, the influence of the state program on local priorities for the enforcement of seismic provisions is lower than the impact of the attentive states' programs and not statistically distinguishable from the influence of the minimalist states. The lesser influence of California's program likely reflects the limited variability in the California data and the inability to disentangle the effects of the presence of a very high earthquake hazard from those of the California mandate. (As shown in Table 3.1, most localities in California give high priority to seismic enforcement.) In general, these findings about state roles suggest that states can be influential in inducing local adoption of regulations, but the extent of that influence depends on the particulars of mandate design and implementation that we have not be able to fully address.

Also noteworthy is the influence of problem characteristics, which accounts for 8 percent of the explained variation in the number of local seismic regulations and 13 percent of the explained variation in the enforcement priority. Differences in the influence of these factors are evident whether one considers the extent of the seismic hazard or experience with damaging earthquakes. The adoption of local seismic regulations is strongly influenced by the occurrence of damaging earthquakes, but no statistically discernable influence is found for the extent of the hazard itself.[3] The role of damaging events is understandable in that they mobilize attention and generate short-lived demands for the adoption of new regulations by local governments. In the absence of damaging earthquakes, there is not much demand for regulatory action, and the existence of earthquake hazards in itself is insufficient to motivate widespread attention.

In contrast to these findings, the extent of the seismic hazard has a noteworthy influence on the priority for enforcement of seismic provisions of building codes, but experience with damaging events has no statistically discernable influence on that priority. This likely reflects the fact that the priority for enforcement is a largely bureaucratic decision by building officials who are generally aware of the extent of seismic risks. This point is reinforced by interviews reported by May (1998) with building officials in the Pacific Northwest. Taken together, the findings about the problem context are reassuring in suggesting that localities do respond at some level to the extent of the seismic hazard. However, the specifics of those responses differ for political actions in adopting regulations and bureaucratic actions in setting enforcement priorities.

The less notable influence of interest group support or opposition to the enforcement of building codes is in keeping with the data cited earlier showing that earthquake issues have generally low salience among local groups except for in the aftermath of major events. These political factors account for less than 2 percent of the explained variation in the number of local seismic regulations and a negligible portion of variation in priority for enforcing seismic provisions of building codes. While the signs of the coefficients are generally as expected, their values are small (relative to other factors) and generally are not statistically significant.

The influence of economic factors is stronger than that of political factors for seismic regulations but they are not a discernable influence on the priority of enforcement. The economic factors account for 9 percent of the explained variation in local adoption of seismic regulations. These differences are in keeping with the findings of the state regulatory literature that economic factors are important aspects of adoption of regulations (see Teske 1994). The positive coefficient for population in both models is consistent with our argument that cities with larger populations have more professional staff who both help to generate and carry out regulations. The negative coefficient for population growth is consistent with the notion that growth strains regulatory capacity and creates pressures to ease enforcement of seismic regulations. The positive influence of the wealth of a locality, as measured by median housing value, on the adoption of regulations is consistent with the expectation that wealth both fosters capacity to regulate and demands for regulation. However, the influence of wealth is smaller in magnitude than other factors and is not statistically significant.

3.4.2 Local Efforts to Enforce Codes

In order to address the implementation of earthquake risk-reduction measures, we consider the effort that local governments put into enforcing different aspects of building codes. The forces that shape the adoption of and priority setting for regulations are also expected to influence implementation. In modeling enforcement efforts, we consider the influence of local regulatory features (the number of local seismic regulations and the priority for the enforcement of seismic provisions), the problem context (seismic hazard), the political context (political demands and opposition to strong enforcement, politicization of enforcement), and the economic context (population in 1990, population growth 1980 to 1990, and median value of housing). We develop separate regression models based on these explanatory factors for the effort put into the review of plans for the construction of buildings, field inspection of construction practices, legal prosecution for noncompliance, and efforts to build awareness of relevant requirements. The results of these models are shown in Table 3.3 for which the cell entries are standardized regression coefficients.

Table 3.3 Examining Implementation of Local Regulations

Explanatory Variables	Regression Models for Variation Among Localities in Enforcement Effort for Various Tasks[a] (standardized coefficients)			
	Review of Plans	Field Inspection	Legal Prosecution	Public Awareness
Local Regulatory Features				
Number of Local Seismic Regulations[b]	.12	-.08	.19**	.06
Enforcement Priority Seismic Provisions of Codes (squared)[c]	.22**	.30***	.17*	.32***
Problem Characteristics				
Seismic hazard (sq. root)[d]	-.14	-.05	-.06	-.07
Political Considerations				
Political demand for stronger code provisions (sq. root)[e]	.16**	.16*	.06	.09
Political opposition to stronger code provisions (sq. root)[f]	-.07	-.03	-.07	.04
Politicization of code enforcement[g]	-.04	-.13*	-.04	-.16*
Economic Considerations				
Population in 1990 (natural log)	.19**	.03	.16*	-.10
Population growth, 1980-89	.12*	.08	-.04	-.05
Median value of housing 1990 (natural log)	.10	.13*	-.03	.09
Adjusted R^2	.23	.16	.12	.12
Significance	P < .001	p < .001	p < .001	p < .001
Weighted Number of localities	216	216	213	213

Notes:

* p < .05 ** p < .01 *** p < .001 (one-tail test)

[a]. Building officials' rating of the effort put into each enforcement activity on a scale of 1 (low) to 5 (high). Squared values are used for review of plans and for field inspection in order to meet regression assumptions.

[b] Number of regulatory provisions for seismic hazards adopted by local governments out of five possible provisions. Higher values represent increased regulatory activity.

[c] Building officials' rating of the priority for enforcement of seismic provisions on a scale of 1 (low) to 5 (high).

[d] Peak ground acceleration (PGA) at 10 percent chance of exceedance over 50 years. Higher values indicate increased seismic hazards.

[e] Percentage of key groups that advocate stronger code enforcement.

[f] Percentage of key groups that oppose stronger code enforcement.

[g] Whether or not political officials in a jurisdiction review appeals of local building code actions.

Two aspects of the findings about the effort put into regulatory enforcement are of particular interest. One is the relative importance of different categories of factors in explaining variation in enforcement efforts. The second is the differential influence of regulatory features and political factors among different aspects of enforcement. The enforcement priority for the seismic provisions of building codes stands out as an important factor across all of the models as evidenced by the magnitude of the standardized coefficients for that factor. However, the impact of seismic priority differs for particular enforcement efforts. It accounts for less than 2 percent of explained variation in plan review and legal prosecution efforts, for 27 percent of explained variation in field inspection efforts, and 55 percent of explained variation in public awareness efforts. These results reveal that greater emphasis on the seismic provisions of building codes signals a desire to be serious about enforcing codes and that this greater emphasis draws attention to those functions that are not normally emphasized in code enforcement. The number of local seismic regulations is also a noteworthy influence upon the effort put into legal prosecution, accounting for 17 percent of the explained variation in legal efforts. This makes sense since legal prosecution is a necessary backstop to compel compliance with building codes (see Burby, May, and Paterson 1998).

In contrast to the findings about the adoption of seismic regulations, political factors are noteworthy influences upon the implementation effort for all enforcement actions except for the effort put into legal prosecution. The three political factors we consider account for 19 percent of explained variation in plan review efforts, 21 percent of the corresponding variation in field inspection efforts, and 28 percent of the explained variation in local efforts devoted to awareness of code provisions. Among the political factors we consider demands for stronger enforcement are noteworthy influences for both plan review and inspection, the critical elements of code enforcement. Political opposition, as expected, has the opposite influence upon these aspects of enforcement. The values of these coefficients are less than half those of political demands. The involvement of elected officials in code decisions has a negative influence on all aspects of enforcement and is especially noteworthy, relative to other considerations, for field inspection efforts and for public awareness efforts. This shows the differential effects of politicization of code enforcement considered in more detail in what follows.

The remaining factors in Table 3.3 are the extent of the seismic hazard and economic factors. The earthquake problem does not have a statistically discernable influence on any aspect of the enforcement effort. This can be explained by two considerations. One is the recognition of the indirect influence of the extent of the seismic hazard. We showed with the results of Table 3.2 that the extent of the seismic hazard strongly influences the priority for enforcing seismic provisions. The results of Table 3.3 shows that the enforcement priority, in turn, affects various aspects of the enforcement effort. A second consideration for the lack of direct impact of the earthquake problem is that the enforcement actions we measure are not specific to seismic provisions of building codes. The economic factors that are statistically significant have positive coefficients. These are in keeping with the notion that they indicate increased capacity to enforce codes.

Left unanswered by the preceding analyses is the importance of local regulatory features and political dynamics in influencing different aspects of enforcement. This is difficult to gage from the regression results of Table 3.3 since it is inappropriate to compare standardized coefficients across models with different dependent variables. A different way of getting at the importance of relevant explanatory factors is to consider what methodologists label an "effects analysis" based on the preceding results. Table 3.4 shows the impacts for different aspects of the enforcement effort of changes in local regulatory features and in political contexts. The cell entries show the percentage change in effort that would be obtained for each explanatory factor if the scores on the factor were to change from that of the lowest quartile (25th percentile) to that of the highest quartile (75th percentile) of all jurisdictions.[4] This set of calculations permits comparisons of the effects of different regulatory features and political contexts for various aspects of enforcement.

These findings reaffirm the noteworthy influence of local regulatory features and political considerations in influencing aspects of code enforcement. Altering local regulatory features leads on average to changes in enforcement effort by as much as 10 to 15 percent. Altering political conditions leads on average to smaller, but still noteworthy changes in the enforcement effort by as much as 7 to 13 percent.

We consider two aspects of local earthquake-risk regulation. The number of seismic regulations that are adopted has the greatest influence on the effort that is put into legal prosecution. We attribute this to the importance of legal action in adding teeth to regulations. These results reaffirm that increased emphasis on the enforcement of seismic provisions has a noteworthy influence on all aspects of enforcement, while providing a clearer depiction than the earlier results of which aspects are most affected. The greatest impact of changes in seismic priority is in fostering a 15 percent increase in effort in building public awareness with the effects on other aspects of enforcement roughly equal in fostering a 10 percent increase. While it is difficult to account for these differential effects, they might reflect fairly widespread recognition among building officials that compliance can be fostered through educational efforts (e.g., in publicizing benefits of codes, making contractors aware of code provisions) as well as through inspection (see Burby, May, and Paterson 1998).

Table 3.4 Regulatory and Political Impacts on Implementation

	Impacts on Effort Devoted to Various Tasks [a] (Percentage change in effort)			
Regulatory and Political Impacts	Review of Plans	Field Inspection	Legal Prosecution	Public Awareness
Local Regulatory Impacts				
Increased number of local seismic regulations	5.9	-2.9	15.2**	3.4
Increased enforcement priority for seismic provisions of codes	9.2**	9.6***	10.7*	15.6***
Political Impacts				
Increased demand for stronger code provisions	12.8**	9.0*	6.9	7.5
Increased opposition to stronger code provisions	-4.9	-1.5	-7.0	3.1
Politicization of code enforcement	-3.0	-7.0*	-4.7	-11.9*

Notes:

* $p < .05$ ** $p < .01$ *** $p < .001$ for regression coefficients used to calculate cell entries.

[a] Cell entries show the predicted percentage change in effort that would be obtained if the values of a given regulatory or political factor were to change from that of the lowest quartile (25th percentile) to that of the highest quartile (75th percentile) of all jurisdictions.

The impacts of political support and opposition to strong code enforcement, shown in the lower part of Table 4, reaffirm that regulatory enforcement is influenced by interest-group dynamics. The impact is the greatest for increased demands by key interest groups for stronger enforcement on the review of plans and on field inspection. We noted earlier that these are critical aspects of code enforcement, which are also under the direct control of building officials. We also found that political interference by elected officials in code decisions reduces the effort that building departments put into field inspection on average by 7 percent and reduces public awareness efforts on average by 12 percent. The increased opposition to enforcement has the greatest impact on efforts for legal prosecution, which results in a 7 percent decrease in legal effort when there is active opposition to code enforcement. The lack of statistical significance of this factor makes us cautious about interpreting the result, but this finding makes sense since groups are likely to attempt to influence the most onerous aspect of regulation.

3.5 CONCLUSIONS

This study of regulatory actions concerning earthquake risk reduction addresses a policy problem that is less salient than those of most analyses of state and local regulations. Earthquake risk reduction entails different regulatory politics and challenges than those of more prominent and immediate problems. The lack of a widespread public constituency advocating risk reduction and the limited concerns of local officials about earthquake risks, create minimal incentives for local governments to address earthquake risks. This calls attention to the role of state requirements and the influence of differing local political and economic contexts in shaping regulatory actions by local governments.

In analyzing these considerations for a sample of 258 local governments in 11 western states, we show that the adoption of seismic regulations and priorities for their enforcement by local governments are strongly influenced by state requirements and by the extent of the problem. The adoption of regulations is more responsive to past earthquakes while the enforcement priority that local building departments give to the seismic provisions of building codes is more responsive to the extent of the earthquake hazard. This distinction reflects a fundamental difference between the political nature of adoption of regulations and the bureaucratic nature of establishing enforcement priorities.

Politicians respond to demands that are mobilized by earthquakes through adopting new regulations, but the pressure to address the problems caused by earthquakes quickly fades as other issues dominate the agenda (see Birkland 1997).

In contrast, the day-to-day priorities for code enforcement are determined by bureaucratic politics operating out of the limelight of particular events. In keeping with the generally low salience of earthquake issues in the absence of major earthquakes, we find that local adoption of regulations and priorities for enforcement are not greatly affected by demands for, or opposition to, stronger building codes by key groups. This is similar to the finding of Bryan Jones (1985) concerning the limited influence of community organizations over amendments to building code provisions in Chicago. This muted influence of interest groups is obviously very different than their notable role in shaping regulatory enactment for more salient issues.

A different picture emerges when we consider the efforts that local building departments put into various aspects of code enforcement for which we found two key influences. One is the nature of local regulation of earthquake risks. Stronger regulations and higher priorities for their enforcement are associated with stronger implementation efforts. This is consistent with the argument that policy design has an important function in signaling to bureaucracies the importance of carrying out particular tasks. In contrast to the muted role of political demands for the adoption of regulations, we found that political factors are noteworthy influences upon the effort that local governments put into different aspects of implementation of building regulations. Political demands for stronger enforcement are especially noteworthy influences on efforts that local governments put into raising public awareness of building codes. The involvement of elected officials in code decisions has a negative influence on all aspects of code enforcement. Such political interference is an especially noteworthy negative influence on field inspection efforts and for efforts to raise public awareness of building codes.[5]

The contrast between the findings concerning the adoption of regulations and their enforcement leads to two key observations about depictions of the politics of less-salient regulatory issues. The common depiction of "routine, bloodless politics" (Gormley 1986: 610) of such regulatory issues is correct if we are talking about the adoption of regulations. In the case of earthquakes, we found muted roles of interest groups as an influence on the adoption of local seismic regulations. Yet we also found evidence that the political dynamic in the aftermath of major events is similar to that of regulatory issues with high salience. A second observation is that politics is not entirely absent from low-salience issues since agencies engage in "street-level politics" in implementing policies. As is consistent with depictions of bureaucratic behavior (Wilson 1989), we found that local building departments tailor their efforts in response to the demands of relevant stakeholders and respond to the involvement of elected officials in agency decision-making about enforcement tasks. Such bureaucratic politics is not bloodless, but it is also not full of the drama associated with more salient issues.

Chapter 3 Notes

1. Many other considerations than the forces measured by PGA affect the extent of the hazard, including the type of soil, the depth of an earthquake, and the duration of an earthquake. When calculating a single measure of the extent of earthquake hazard for any location, the frequencies with which earthquakes occur also need to be taken into account. We select values for which over a 50-year period there is a 10 percent change of an event with the given PGA or larger. More generally, the PGA is a common reference standard for assessing the forces that are experienced by buildings smaller than seven stories in height. Shoaf and Bourque (1999) show that the PGA values for different locations in Los Angeles serve as good predictors of the residential damage experienced in the Northridge earthquake in 1994.
2. The U.S. Geological Survey (USGS) maintains a website that contains a searchable database of seismic hazards by zip code for all states except Alaska and Hawaii. (The Uniform Record Locator for this site is http://geohazards.cr.usgs.gov/eq/html/zipcode.shtml.) For localities with population of less than 100,000, we based the PGA measure on the zip code for the central part of each locality. For each city over 100,000 population, we calculated the PGA for all valid zip codes for the city and used the 75th percentile of reported PGA values. The PGA values for localities in Alaska were determined from hazard maps available from the USGS from the same electronic location.
3. This is partially explained by the fact that the variables measuring differences in state seismic regulatory programs also capture differences in the extent of earthquake hazard. When the state regulatory variables are excluded, the extent of seismic hazard has a noteworthy influence ($B = .34$, $p < .001$) but the overall adjusted R^2 is reduced by 9 percentage points. Exclusion of state regulatory program variables does not change the statistical effects of prior earthquake disasters in explaining the number of local seismic regulations. Similarly, it does not affect the influence of either the extent of seismic hazard or of prior earthquake disasters in explaining the enforcement priority for seismic provisions of building codes.
4. These are calculated by comparing the predicted values obtained from the unstandardized regression models that parallel those of Table 3 when substituting for

the variable of interest the values at the 25th and 75th percentiles. For the remaining variables in the equation, the mean value of all jurisdictions is employed. The percentage change in predicted values is the policy effect.

5. Not surprisingly, Jones (1985) found a strong influence of political party and ward politics on code enforcement decision-making in Chicago. Of more relevance to our study is the additional finding of Jones that bureaucratic decision-making rules, as modified by political pressures, were also important factors in shaping enforcement functions in Chicago.

Chapter 3 References

Berke, Philip R., and Timothy Beatley. 1992. *Planning for earthquakes: Risk, politics, and policy.* Baltimore: Johns Hopkins University Press.

Birkland, Thomas A. 1997. *After disaster: Agenda setting, public policy, and focusing events.* Washington, D.C.: Georgetown University Press.

Burby, Raymond J. 1995. Coercive versus cooperative pollution control: Comparative study of state programs to reduce sedimentation pollution in urban areas, *Environmental Management* 19 (3): 359–70.

Burby, Raymond J., and Linda C. Dalton. 1994. Plans can matter! The role of land use plans and state planning mandates in limiting the development of hazardous areas. *Public Administration Review* 54(3): 229–37.

Burby Raymond J., and Peter J. May with Philip R. Berke, Linda C. Dalton, Steven P. French, and Edward J. Kaiser. 1997. *Making governments plan: State experiments in managing land use*. Baltimore: Johns Hopkins University Press.

Burby, Raymond J., Peter J. May, and Robert C. Paterson. 1998. Improving compliance with regulations: Choices and outcomes for local government. *Journal of the American Planning Association* 64 (3): 324–34.

Comerio, Mary C. 1998. *Disaster hits home: New policy for urban housing renewal*. Berkeley, Calif.: University of California Press.

Deyle, Robert E. and Richard A. Smith. 1998. Local governmental compliance with state planning mandates: The effects of state implementation in Florida. *Journal of the American Planning Association* 64 (4): 457–69.

Gormley, William T. Jr. 1986. Regulatory issue networks in a federal system. *Polity* 18 (summer): 595–20.

Jenks, Stephen. 1994. County compliance with North Carolina's solid-waste mandate: A conflict based model. *Publius: The journal of federalism* 24 (spring): 17–36.

Jones, Bryan D. 1985. *Governing buildings and building government.* University, Ala. University of Alabama Press.

Leyendecker, E. V., D. M. Perkins, S. T. Algermissen, P. C. Thenhaus, and S. L. Hanson. 1995. *USGS spectral response maps and their relationship with seismic design* *forces in building codes.* Open file report 95-596. Reston, Va.: U.S. Geological Survey.

May, Peter J. 1998. Anticipating earthquakes: Risk-reduction policies and practices in the Puget Sound - Portland Areas. In *Assessing and reducing earthquake hazards in the Pacific Northwest*, vol. 2, pp. 497-515, A. M. Rogers, W J. Kockelman, G. R. Priest, and T. J. Walsh, eds. U.S. Geological Survey Professional Paper 1560. Washington, D.C.: U.S. Government Printing Office.

May, Peter J. 1991. Addressing public risks: Federal earthquake policy design. *Journal of Policy Analysis and Management* 10 (spring): 263–85.

May, Peter J., and Thomas A. Birkland. 1994. Earthquake risk reduction: An examination of local regulatory efforts. *Environmental Management* 18 (6): 923–37.

National Conference of States on Building Codes and Standards. May 1992. *Seismic provisions of state and local building codes and their enforcement*. Washington, D.C.: National Institute of Standards and Technology, U. S. Department of Commerce,.

Noam, Eli. 1982. The choice of governmental level in regulation. *Kyklos, The International Review of Social Sciences.* Fasc. 2: 278–91.

Page, Robert A., David M. Boore, Robert C. Bucknam, and Wayne R. Thatcher. 1992. *Goals, opportunities, and priorities for the USGS earthquake hazards reduction program.* United States Geological Survey Circular No. 1079. Washington, D.C.: Government Printing Office.

Palm, Risa. 1995. *Earthquake insurance: A longitudinal study of California homeowners.* Boulder, Colo.: Westview Press.

Ross, H. Laurence. 1995. Housing code enforcement as law in action. *Law and Policy* 17 (April): 133–60.

Shoaf, Kimberley I., and Linda B. Bourque. 1999. Correlates of damages to residences following the Northridge Earthquake. *Earthquake Spectra* 15 (February): 145–72.

Teske, Paul. 1994. The state of state regulation. In *Handbook of regulation and administrative law,* 117-–37. David Rosenbloom and Richard Schwartz, eds. New York: Marcel Dekker.

Wilson, James Q. 1989. *Bureaucracy: What government agencies do and why they do it.* New York: Basic Books.

4 Earthquake Entrepreneurs: Local Seismic Regulation in California

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4.1 INTRODUCTION

If necessity is the mother of invention, then its father was almost certainly an entrepreneur. The entrepreneurial spirit is one of the bedrock beliefs of our culture, and has been the catalyst for countless innovations, discoveries, and inventions for more than 250 years. Yet only recently have political scientists begun to consider the phenomenon of the public entrepreneur — the individual who innovates, not for profits, but for policies, foregoing private sector opportunities to pursue interests in the public sector.

A number of studies have identified entrepreneurs as key elements in the development of policy innovations. Kingdon's (1984) characterization of policy entrepreneurs as opportunistic players alert for windows of opportunity through which to further their policy preferences is widely known. Baumgartner and Jones (1993) find that entrepreneurs are critical for breaking up the policy subsystems that tend to form around issues during long periods of incrementalism. Schneider and Teske (1992) find evidence of policy entrepreneurs at the municipal level, and Mintrom (1997) has documented their impact on school choice at the state level.

Wilson (1980) finds that entrepreneurial politics are not distributed equally across policy types, but tend to concentrate in areas where collective action problems make them less responsive to traditional politics. When policy costs are largely focused on a small segment of the population, and benefits are broadly diffused, incentives to organize are strong for policy opponents but weak for beneficiaries. According to Wilson, the adoption of the policy under these circumstances, "…requires the efforts of a skilled entrepreneur who can mobilize latent public sentiment. …" (370). Schneider and Teske's (1992) survey of 1400 municipal clerks for examples of entrepreneurial activity in local government describes a cost/benefit calculus of public entrepreneurs similar to that of the private entrepreneur. They find that entrepreneurs at the local level are attracted to policy areas where the "costs" of mobilizing support and overcoming entry barriers are outweighed by the "benefits" of opportunities to further their policy objectives. They also identify a number of factors common to localities with entrepreneurs, including greater financial resources, lower percentages of renters, and higher levels of some types of budgetary resources.

A number of efforts have looked at the importance of the entrepreneur for issues of "public goods" with well-defined, (but often unorganized) constituencies, such as environmental policy, auto safety, civil rights, or school choice. Overlooked in these analyses has been a discussion of what May (1991) terms "public risks" which are broadly distributed, centrally produced, and usually outside the control or understanding of the risk bearer. Prominent examples of public risks are earthquakes, epidemics, hurricanes, or ozone depletion. Public risks are often characterized by a different set of obstacles than public goods, most notably the lack of public attention in the absence of a focusing event. The role of the entrepreneur in these cases is much less certain, since high levels of public apathy make mobilizing support more difficult, imposing additional costs. Yet the opportunities for innovation in public risk regulation are clearly substantial, particularly in the area of natural hazard mitigation.

Since the late 1980s, the number of hurricanes, floods, tornadoes, and earthquakes in the United States has risen dramatically, ending nearly a century of relative calm (see Comerio 1998). Levels of exposure have also increased as prosperity and changing work patterns concentrate development and population in highly vulnerable areas along the East, West, and Gulf coasts. According to 1990 census figures, greater than 50 percent of our population now live in high-density, high-hazard coastal areas, where even moderate future events could overwhelm current disaster management capabilities. One need look no farther than damage from Hurricane Andrew or the Northridge earthquake to find plentiful opportunities for policy entrepreneurs. If they are active in public risks regulation, as they are in public goods regulation, natural hazards mitigation is an ideal place to document their influence.

Although there are a number of regulatory tools available, natural hazards are routinely controlled through the adoption and enforcement of building codes. Of states with both a high exposure to hazard and a history of innovation, California tops the list in both categories, with 19 large earthquakes this century (Comerio 1998, 12), and 13 major pieces of statewide legislation aimed at reducing earthquake damages. Moreover, Californians have a reputation for being highly informed and well prepared for seismic events, suggesting a lower level of apathy that may be attractive to entrepreneurial activity.

This paper examines the adoption of local seismic policies in California for evidence of the influence of policy entrepreneurs, using data from a mail-out survey of local building department officials conducted in 1995. It is one of few such efforts to be conducted at the local level; and perhaps the first to examine entrepreneurial influence in an area of public risk. The first section gives a brief background of state mandates relevant to local seismic policy. The second constructs a simple theoretical framework and discusses the expected role of entrepreneurs within that framework. The third is a discussion of the data and measures used in the study. The fourth section examines the influences that shape earthquake policy outputs, including the relative roles of entrepreneurs, other political actors, and the policy environment.

4.1.1 State Level Legislation

Seismic regulations have been a part of the policy picture in California for a long time. Thirteen major pieces of seismic legislation have been enacted by the legislature since 1933. In comparison, Alaska, Arkansas, and Missouri have each passed one statute; the remaining 46 states have none. Of these 13, four are particularly important for this discussion, because each created a new level of seismic mandate that both restricted and empowered local governments. In doing so, each created a window of opportunity for local policy entrepreneurs. Some have responded to the mandates, others have not. The study of the variation in these responses is the heart of this research. It is useful therefore to understand the nature and sequence of state efforts to encourage local innovation, as several of the measures used later are derived from these statutes.

The Field Act was enacted in 1933 to address concerns over the safety of public schools following the Long Beach earthquake of 1933. Although not of immediate impact to private property owners, the Field Act was pivotal in establishing the legitimacy of state imposed requirements on local hazard mitigation efforts.

In 1971, the state experienced substantial property damage from the effects of the San Fernando Earthquake. This event sharply focused the attention of local governments and citizens throughout California to the potential dangers from similar surface ruptures along faults in their own jurisdictions. There was, however, a significant lack of geologic information available at this time at the local level, and planners and other local decision makers were often unaware of the geological characteristics of their regions. The Alquist-Priolo Earthquake Special Studies Zone Act (1972) provided a mechanism for identification and mapping of active faults, and mandated restrictions on all development within designated fault zones. It also included a general provision that required local governments to incorporate elements of seismic safety into their general plan, but did not specify the nature of the elements.

The Unreinforced Masonry Building (URM) Law of 1986 required cities and counties in high seismic hazard zones to identify potentially dangerous URMs, notify owners that they might constitute a hazard, and file a proposed mitigation report with the state. It did not, however, require owners to strengthen their buildings, nor did it require local governments to implement mitigation programs.

By the late 1980s, scientists had concluded that as much as 95 percent of the economic losses incurred during an earthquake occurred not directly over the fault line, but as a result of "strong ground shaking, liquefaction, landslides, or other ground failure," and would be spread much more widely than predicted by the Earthquake Fault Zone maps (SHMA, 2691a). They further concluded that "areas subject to these processes during an earthquake have not been identified or mapped statewide, despite the fact that scientific techniques are available to do so" (SHMA, 2691b). The California Seismic Hazards Mapping Act (SHMA) was passed in 1990 in response to these concerns, with the specific intent "to gather and disseminate information to cities, counties, and the public on the hazards of shaking, landslides, and liquefaction" (SHMA, 2692a). Once mapped, SHMA required cities and counties to regulate new development in designated regions to avoid the hazard or mitigate the level of exposure.

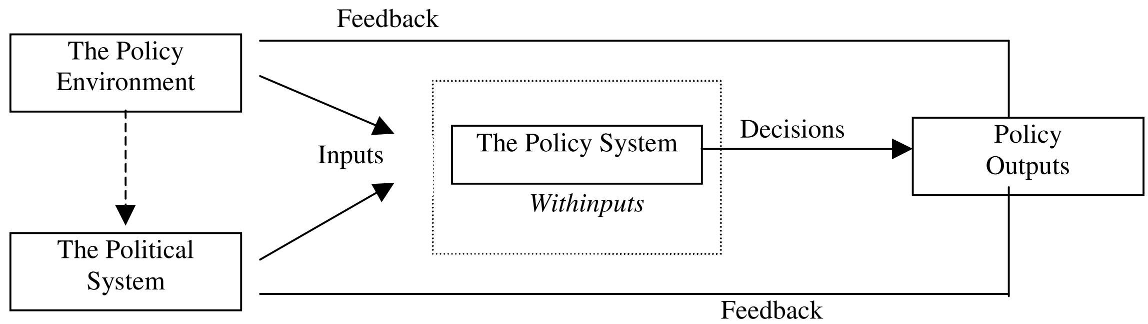
California's level of seismic regulation is unquestionably the most aggressive in the nation. State mandates have set the stage for local entrepreneurs, giving them the information, authority, and motivation to adopt innovative seismic regulations. Yet local jurisdictions, even in California, retain a high degree of autonomy when it comes to the formulation and implementation of seismic hazard policies.

4.2 THEORETICAL FOUNDATIONS

The principal task of this section is to construct a framework that will support a discussion of the influence of policy entrepreneurs; or, in other words, to create a context within which to explore differences in local policy choices. The central question of this study is similar to that of all output studies: what causes the variation in levels of local seismic regulation in California? Yet whether the hypotheses for variation are pluralistic, institutional, or entrepreneurial; a fundamental framework of the policy process is an essential prerequisite to the inquiry.

4.2.1 Systems Theory

An appropriate framework for studies of outputs is David Easton's model of policy systems (Easton 1957). Easton was among the first to suggest that policy development is not simply the random interaction of a host of independent variables, but rather that policymakers respond systematically to inputs and produce outputs in predictable ways. The systems theory he developed is simple and robust, yet broad enough to permit the investigation of more specialized hypotheses within its framework. Perhaps because of this fact, his categorizations and their numerous variants have formed the basis for more than 100 studies of policy outputs over 30 years (see Boyne 1985).



Source: Adapted from Boyne (1985).

Figure 4.1 The Policy Systems Model

The model presented in Figure 4.1 is a variant of Easton's original, similar to those commonly used to study the policy process. By choosing policy as the measure of system output, it defines policymaking as the central system activity, theoretically separate from other political activities. Inputs to the system are simplified into three categories: the formal political system, the policy environment, and *withinputs*, or inputs from within the system itself. A good deal of the debate surrounding Easton's work has been over the definitions of these categories; therefore a brief discussion of each is useful to conceptually clarify the framework.

4.2.1.1 Establishing Boundaries: The Political System

Easton originally defined the boundaries of a political system as, "…all those actions more or less directly related to the making of binding decisions for a society" (Easton 1957, 385). For this model, a slightly finer distinction is made between actions by which societal decisions are *made,* and actions by which these decisions are *influenced*. The formal political system includes all actions more or less directly related to the *influencing* of societal decisions. More specifically for this study, the political system influence is measured through such things as local elected official involvement, interest group activity levels, and state and federal influences.

4.2.1.2 The Policy System

The policy system, in contrast, is the process by which societal decisions are *made* and outputs produced. Although there is sound theoretical basis to distinguish it from the broader political system, the policy system is nonetheless difficult to measure in isolation. The majority of output studies use measures of outputs directly to approximate the effects on the policy system, and a similar approach is taken here. For this study, the policy system will be represented by its outputs. More specifically, a measure of seismic innovation is operationalized for the level of innovative seismic policies adopted by each community,

4.2.1.3 The Policy Environment

For Easton, reality is composed of interacting systems, both physical and socially constructed. When studying a system, the environment is defined simply as all actions and conditions occurring outside the boundaries of the system. For the political system, that refers to actions and conditions not "…related to the making (or influencing) of binding decisions for a society" (Easton 1957, 385). For this study, consideration of the policy environment is limited to the natural and governmental conditions that are likely to influence local governments in adopting innovative policies. More specifically, the policy environment will be measured by such things as the level of seismic hazard, the level of development at risk, and the economic capacity of the community.

4.2.1.4 Inputs from Within

A third source of inputs come from within the policy system itself. Easton acknowledges the role of independent decision-maker actions on outputs, noting that, "Demands just do not suddenly become transformed into outputs nor are they just inexplicably blocked" (Easton 1965, 72). This category of variables, dubbed *withinputs*, refer to the ordering and prioritizing of inputs, as well as the attitudes and strategies of policy makers. It should be remembered however, that these variables are undeniably more political than environmental. In our examination therefore, they will be grouped with other political factors. For this study, the level of *withinputs* will be measured by the attitudes and practices of local building department officials.

By looking at outputs and framing the investigation in terms of the systems theory, a number of improvements can be made over previous studies of entrepreneurial politics. First, the ordinal measurement of policy outputs is an improved indicator of entrepreneurial activity over previous dichotomous measures (see Schneider and Teske 1992; Mintrom 1997). Second, the policy output format is an effective tool for comparing differences across local governments. Third, the systems model framework allows a discussion of the relative importance of political versus environmental factors in influencing entrepreneurial policies. And fourth, the selection of seismic regulation facilitates a comparison of entrepreneurial influences on “public risk” policies with previous studies on the provision of “public goods.”

4.2.2 The Role of Local Entrepreneurs: Proposition 1

The major theories of entrepreneurial politics (Kingdon 1984; Wilson 1980,;Baumgartner and Jones 1993) so prominent at the national level, have gone largely unconsidered in studies of county and municipal governments. The fact that public entrepreneurs exist at the local level is not surprising, of course. Anyone who has studied or worked in the public sector can cite examples of entrepreneurial behavior. What is more surprising is the suggestion, articulated by Schneider and Teske (1992), that entrepreneurs do not appear randomly, but systematically and predictably.

Wilson (1980) notes that there are some types of policies for which traditional politics are simply ineffective. Specifically, when a proposal provides benefits to society that are long-term and broadly diffused, while the costs of the proposal are focused on a small segment of society, ordinary pluralist strategies simply will not work. Opposition mobilizes, but support does not. Wilson asserts that whenever we witness this type of policy proposal, and particularly when we see its adoption, we are witnessing entrepreneurial politics (370).

In this case, despite the presence of numerous state seismic mandates, few governments have adopted aggressive seismic programs. The mitigation of seismic threats is a textbook example of this type of policy. Disasters are low probability events, and elicit generally low attention levels from both policymakers and the public, even with high levels of information about the hazard. Costs associated with seismic regulations are generally borne by small segments of the community, usually the housing industry or homeowners. Wilson calls the adoption of such regulations unlikely without the efforts of a skilled entrepreneur. Therefore:

Proposition 1: It is expected that the level of seismic regulation in the majority of communities will be moderate or low, and that high levels of seismic regulation will be related to the presence of entrepreneurial influences.

4.2.3 Politics versus Environment: Proposition 2

A large portion of the output studies literature has been devoted to the question of the relative importance of the political system and the policy environment. Early studies suggested that the policy environment played the dominant role in policy outputs, but were criticized for having inadequately operationalized political variables. Subsequent efforts however, may have erred to the other extreme, stacking the deck, so to speak, by including many more political measures than environmental (see Boyne 1985 for a summary).

Turning to the specific case of seismic regulation, there is theoretical support for both groups as well. The strong connection between seismic hazard levels and seismic regulation suggests an intuitive advantage for the policy environment. Furthermore, in examining state earthquake regulation choices, Burby and May (1998) found a strong relationship between the level of risk and seismic enforcement policies. On the other hand, Wilson insists that collective action problems make seismic innovations unlikely without the political actions of an entrepreneur. Therefore:

Proposition 2: It is expected that both the political system and the policy environment will be positively related to seismic regulation, and that the measures reflecting seismic hazard and entrepreneurial activities will exert the strongest influence. It is more difficult however, to theoretically predict their relative importance to seismic regulation.

4.3 DATA

The data used for this study were taken from a 1995 mail-out survey of local building officials conducted by Burby, May, and Patterson (1998). The sample frame for the survey was based on a 1992 national survey conducted by the National Conference of States on Building Codes and Standards that addressed state and local capacity to enforce the seismic safety provisions of building codes (see Burby and May 1998).

An oversampling of 401 California jurisdictions provides a unique opportunity to examine the forces that influence local policy systems in an environment where state influence is held constant. For this study, city and county governments were selected for locations with populations greater than 2500. Responses were obtained from 292 local governments in California, resulting in a response rate of 73 percent.

A preliminary analysis of the distribution revealed an over-representation of large places combined with an under-representation of small places. Less than 7 percent of California jurisdictions have populations greater than 100,000, yet they represented roughly 13 percent of the responses. Similarly, more than 45 percent of jurisdictions have populations less than 10,000, yet only 20 percent of responses were from these places. To address this issue, the data were weighted in 5 population categories, more accurately reflecting the natural distribution of California cities and counties reported in the 1990 Census.

4.4 MEASURES

One of the most critical elements of any analysis is the careful operationalization of key theoretical concepts. For the analyses that follow, a number of measures are needed to capture the influence of entrepreneurial politics in the context of both the political system and the policy environment. The development of the dependent variable, seismic regulation, is outlined first. This is followed by a discussion of political system measures that are selected to represent entrepreneurial activity, and measures that control for political influences unrelated to entrepreneurial activity. Following this, measures of the policy environment and their expected relation to entrepreneurial effects are discussed.

4.4.1 Seismic Regulation: The Dependent Variable

The dependent variable for this analysis is derived from an interesting sequence of questions on the 1995 survey. Based in part on the statutory mandates outlined earlier, survey respondents were asked to identify which of five types of seismic regulation had been adopted by their jurisdiction. The regulation types were as follows:

- Restriction on new development in fault zones or areas with unstable soils
- Special inspections or reports for new construction in seismic hazard areas (e.g. liquefaction, steep slopes)
- Seismic reinforcement of existing structures (e.g., parapet ordinance, seismic reinforcement of dangerous buildings)
- Securing hot water heater to existing structures
- Economic incentive programs to encourage retrofitting existing structures to meet current codes

Over a 25-year period, the state of California had either encouraged or required local governments to adopt each of these measures. At the time of the survey, localities were required to restrict development in fault zones (Alquist-Priolo 1972) and to require special reports for new construction in identified seismic hazard areas (Seismic Hazard Mapping Act, 1990). Programs for the seismic reinforcement of existing structures was encouraged, but not mandated (Unreinforced Masonry Building Act 1986). Requirements to secure hot water heaters were mandated in 1996, but were only encouraged at the time of the survey (California Health and Safety Code 1999). Cost sharing and tax abatement programs for retrofitting were also encouraged through state tax provisions, but were generally beyond the reach of all but the most ambitious localities.

Taken together, responses to these five questions paint an excellent picture of the level of seismic regulation in each community. Two measures are required; three are encouraged. Two apply solely to new construction; three are aimed at existing structures (although most hot water heater ordinances apply to both). The costs of adoption range from very low, for hot water heater attachment, to very high, for cost sharing and tax abatement. Summing the number of seismic programs for each community creates a composite measure of seismic regulation that is highly responsive to the efforts of policy entrepreneurs. The resulting *index of seismic regulation* has a potential range from 0 to 5, and the mean value of the weighted sample is 2.02.

4.4.2 Measuring Policy Entrepreneurs

A variety of factors influence the local policy process, but only a few reflect the activities of an entrepreneur. The accepted descriptions of entrepreneurs are as individuals who initiate dynamic changes in policy systems. In local governments, there are three primary sources of individuals that can have a dynamic impact on policy. These are elected politicians, such as mayors or city council members; high-level unelected bureaucrats or managers; and leaders of organized interest groups. If the adoption of innovative seismic regulations requires the efforts of a skilled entrepreneur, as Wilson suggests, the measures for each of these groups should have a significant, positive relationship to seismic regulation.

The impact of elected officials is measured for this study through two primary aspects: attention and involvement. The logic is that elected officials who are attentive to and involved with their building departments are more likely to be concerned with and proactive about seismic regulation. Attention is measured as local officials' level of understanding of building department function. The level of elected official involvement in building department decisions is a direct measure taken from the survey.

Building department officials play a crucial role in making seismic policy; they are the central decision-makers of the policy system. Although elected officials generally adopt local ordinances, at least three of five components of seismic regulation could be implemented by building officials directly. A policy entrepreneur at this level would be expected to emphasize seismic hazard mitigation, both with regard to staffing levels and the enforcement of existing seismic regulations. For this study, the number of seismic specialists in each community and the priority score assigned to seismic enforcement by survey respondents were selected to represent the attitudes of building department officials.

Interest groups are the third potential source of policy entrepreneurs. Entrepreneurs are common in these organizations, but vary greatly in their level of success. Influence seems generally dependent on the ability to organize and mobilize support. In communities where they are active however, it is expected that they will play a role in influencing policy. Two different measures were needed to capture the influence of interest groups: one for economic stakeholders and another for advocacy groups. This is because the association for advocacy groups is expected to be positive, but economic stakeholders are expected to show a negative association.

Survey respondents were asked which, if any, of several interest groups were active in their community. The stakeholders measure is the sum of architects organizations, general contractors associations, and homebuilders associations; while the advocacy measure is the sum of environmental groups, historic preservation groups, and neighborhood groups.

4.4.3 Non-Entrepreneurial Political Factors

To determine the true impact of policy entrepreneurs, political influences from outside the local system need to be controlled also. The influence of state mandates has already been discussed at some length, and is expected to have a significant, though possibly small, effect. It is included as the respondents' estimate of the role state requirements played in the last revision of local codes. Population is included to control fundamental differences between large and small cities, such as level of development and the degree of staff specialization. Lastly is a measure to capture the residual effects of previous federal disasters, such as earthquakes, hurricanes, or floods. The presence of a previous event is expected to increase attention levels in the community, fostering a political environment conducive to entrepreneurs. This measure also captures the substantial economic resources provided through federal disaster recovery programs, and is therefore included in the policy environment model as well.

4.4.5 The Policy Environment

The policy environment, as Easton notes, is inherently vast and complex. Most commonly in studies of policy outputs, the environment is expressed as the economic context in which policymaking occurs. However, there are two dimensions of the local policy environment that are important for the study of entrepreneurial influence: the nature of the problem or risk, and the capacity of governments to adopt regulation.

Three measures are used to capture seismic risk, one for the natural hazard and two for the level of exposure. Peak Ground Acceleration (PGA) is used to measure the level of natural hazard in the community. It is essentially a measure of the highest predicted ground motion level at each location, for a given level of probability and period of time. One of several potential measures for seismic hazard, PGA is widely accepted in the engineering community, and is the most appropriate for comparing hazard levels across communities (see Shoaf and Bourque 1999). A more complete discussion of hazard measures can be found in appendix A.

In addition to the natural hazard, development levels are an important part of the local risk equation. The level of urban density and the ability of existing structures to withstand seismic events are good indicators of the overall condition of the developed environment in a community. To capture these effects, measures are included of the percentage of urbanization and the percent of housing built before 1972.

The capacity of local governments to adopt regulations is usually a function of economic conditions in the community. Property tax revenues are a good indicator of the long-term wealth of a community, and are preferred for this study over income measures because building departments are usually funded from property taxes. The level of housing pressure, measured by the vacancy rate, taps a second dimension of economic conditions. Low vacancy rates are usually associated with strong economic growth and pressure for increased development, and are expected to both strengthen opposing interests and divert the attention of policymakers from seismic regulation.

4.5 EXAMINING ENTREPRENEURIAL EFFECTS

The analysis of entrepreneurial factors on seismic regulation can be productively considered in two parts. In the first, the nature of seismic regulation in California is examined. The distribution among jurisdictions is described, and the characteristics of localities with innovative programs. This paints a picture of the background factors underlying the local policy process, and sets the stage for the regression analyses that follow. In the second part, a series of three models are tested against the theoretical concepts earlier developed. The first tests the relationships of political variables on seismic regulation. The second tests the variables representing the policy environment. The third defines the relative importance of the policy environment and the political system by incorporating both into a single, combined model.

4.5.1 The Distribution of Seismic Regulation

Table 4.1 presents the choices of local governments with respect to seismic regulation. It shows that the most commonly adopted seismic provision in California is the simplest and least costly measure: the requirement that hot water heaters be secured. Nearly three-quarters of local governments statewide have adopted this provision. By contrast, less than one in ten has adopted the more costly and complex measure of compensating building owners for retrofitting.

Table 4.1 Summary of Seismic Regulations
Percent of Localities With Each Ordinance or Program

Securing hot water heater to existing structures	70%
Seismic reinforcement of existing structures (e.g., parapet ordinance, seismic reinforcement of dangerous buildings)	69%
Special inspections or reports for new construction in seismic hazard areas (e.g., liquefaction, steep slopes)	62%
Restriction on new development in fault zones or areas with unstable soils	42%
Economic incentive programs to encourage retrofitting existing structures to meet current codes	8%

This distribution suggests that seismic regulation is not strongly tied to state requirements. While 62 percent of localities have incorporated requirements for special inspections or reports in seismic hazard areas, as required by the Seismic Hazard Mapping Act, less than half (42 percent) have responded to similar state requirements to limit development in fault zones (Alquist-Priolo). Moreover, two of the three voluntary measures (reinforcement ordinances and hot water heater restrictions) have been adopted by more jurisdictions than either of the mandated measures. Clearly, the presence of state mandates is not the sole determinant of local seismic policy.

Yet the vast majority of local governments have accepted at least some level of seismic regulation. 80 percent have adopted at least one of the five measures, and 64 percent have at least two. Beyond this nominal level of acceptance however, numbers drop dramatically. Fewer than half have adopted three or more measures, (38 percent); and fewer still have four or all five (15 percent and 4 percent respectively).

In Table 4.2, the relationship between seismic hazard, city size, and the level of adoption is explored. A visual examination, as well as the more precise test for difference of means, reveals that both population and Peak Ground Acceleration are strongly correlated with the number of measures adopted. This means that larger cities tend to adopt more regulations than smaller cities. Similarly, locations with high hazard levels adopt more measures than low hazard areas. Though the relationships are interesting and highly significant, they quickly fall short in explaining small cities with high hazards or large cities with low hazards. They do, however, lay the groundwork for the subtler modeling of relationships that is possible through regression techniques.

Table 4.2 Characteristics of Local Governments by Level of Seismic Regulation
Comparison of Means

Seismic Regulation (Number of Measures Adopted)		Peak Ground Acceleration	Population 1990
0	Mean	29.00	26,000
1	Mean	35.00	37,000
2	Mean	49.00	56,000
3	Mean	49.00	43,000
4	Mean	54.00	251,000
5	Mean	48.00	456,000
Difference of Means	F Test	p<.001	p<.01

4.5.2 The Political Model

The first model tested is limited to the influence of political factors. It captures the variation in seismic regulation that is explained by local and external political influences. The results, displayed in Table 4.3, reveal a highly significant relationship for this model. Overall, the model accounts for 22 percent of seismic regulation variance.

Entrepreneurial variables account for approximately 76 percent of the explained variance, with external political influences accounting for the remaining 24 percent.

The coefficients for individual variable scores are presented in standardized units throughout the analysis to facilitate a direct comparison with other variables. The t-statistics are also reported to indicate the exact degree of significance for each variable. In this case, highly significant relationships are revealed for variables in each category of entrepreneur. This means that the level of seismic regulation in a community is statistically related to the activities of entrepreneurs as measured by each of the three categories.

The weakest of entrepreneurial category influences are from local elected officials. This may be because they lack the single-issue focus characteristic of interest groups and building department officials. Yet the influence is weak only by comparison with other entrepreneurial groups. Compared with external political influences, such as state requirements or previous disasters, the impact of elected leaders is more powerful. For local elected officials, the strongest indicator of support for seismic regulation is the level of understanding. The relationship for this measure is in the expected positive direction, and the coefficient is reasonably large. The measure for elected official involvement is not significant; however, this is likely due to confusion in the original measure between supportive involvement and involvement for the purposes of political control.

Table 4.3 The Political Model
Political Influences on Seismic Regulation

	Standardized Coefficient	t Statistic
Entrepreneurial Sources		
Local Elected Officials		
Understand Building Department functions[a]	.18**	2.7
Involved in Building Department decisions	-.08	-1.1
Interest Groups		
Economic Interest Groups[b]	-.14*	-1.8
Advocacy Interest Groups[c]	.21**	2.7
Building Department Officials		
Seismic Enforcement Priority Score	.26**	3.9
Number of Seismic Specialists on Staff [d]	.15*	1.7
External Political Influences		
State Requirements	.15*	2.2
Past Disaster	.15*	2.2
Population (1990) [d]	.03	.30
Adjusted R^2	.22	
Significance	p<.001	
Weighted Number of Localities	185	

* p < .05 (one tail test)
** p < .01 (one tail test)
*** p < .001 (one tail test)
[a] variable coding was reversed
[b] architects, engineers, contractors, and homebuilders organizations
[c] historic preservation, environmental, and neighborhood groups
[d] natural log of variable used
[e] square root of variable used

The role of interest groups, both economic and advocacy, is surprisingly strong in this model, especially since few groups actively target seismic regulations. Once again, the highly significant relationship between interest group levels and seismic regulation strongly supports the entrepreneur hypothesis. Economic interests generally bear the costs of seismic regulation, and therefore, as expected, show a negative coefficient. The coefficient for advocacy groups is larger than that of economic groups, suggesting that where active, they have a greater influence on policymaking. This is perhaps because they are more likely to make use of formal political strategies than economic groups, who prefer informal strategies that are not captured by this measure.

The most effective category, by far, for influencing seismic regulation are building department officials. This is not surprising, since building department officials are in a better position to advance their seismic preferences than either elected officials or interest group leaders. Entrepreneurs in this group combine the dedication and focus of interest groups with high credibility and direct access to the policy process. Taken together, the two measures of building officials' attitudes account for nearly a third of the variance explained by the model, and the coefficients for individual measures are large and positive. The strongest single indicator in the model is the priority given to seismic enforcement. This single factor has an effect that is nearly double many others, and substantially higher than any other. The secondary measure of the number of seismic specialists is weaker, but only by comparison with the seismic enforcement score.

Two of the three non-entrepreneurial controls were also statistically significant in the model. The level of state requirements was significant and moderately influential, as were the impacts of a past disaster event. Both were positively related to seismic regulation, but the coefficients were moderate and within the range consistent with theoretical expectations.

4.5.3 The Policy Environment Model

The second model tests the effects of the background environment within which policies are made. The relative explanatory power of the environment is of particular interest for this study, since at least to some degree the need for regulation of any kind is dependent on the level of seismic hazard. In contrast to other environmental regulation issues such as ozone depletion or global warming, where policies are tied to potential future hazards, the need for seismic regulation is tied to a clear, concrete, and current level of hazard.

The results, presented in Table 4.4, reveal that the environment is a highly significant source of influence for policymakers. Overall, environmental factors account for 18 percent of the total variance in seismic regulation, and five of the six measures are statistically significant. The effects of the environment are spread fairly evenly between the two dimensions measured in this model. Of the explained variation, 46 percent is the product of natural risk measures, while 54 percent is due to the economic conditions in local communities.

Table 4.4 The Policy Environment Model
Influences from the Policy Environment on Seismic Regulation

	Standardized Coefficient	t Statistic
The Nature of the Problem		
Measures of Risk		
Seismic Hazard Level (PGA)[e]	.24***	3.6
Level of Urbanization	.12*	1.7
Percent of Old Housing	.03	.51
Capacity to Adopt Regulation		
Economic Conditions		
Long Term Community Wealth	.14*	2.0
Housing Pressure	.13*	1.9
Population (1990) [d]	.16**	2.8
Adjusted R^2	.18	
Significance	p<.001	
Weighted Number of Localities	277	

* p < .05 (one tail test)
** p < .01 (one tail test)
*** p < .001 (one tail test)
[a] variable coding was reversed
[b] architects, engineers, contractors, and homebuilders organizations
[c] historic preservation, environmental, and neighborhood groups
[d] natural log of variable used
[e] square root of variable used

Individually, the level of seismic hazard is clearly the most influential variable in the model. The coefficient is twice as large as the other indicators of natural risk, and nearly twice as large as any single measure for economic conditions. Clearly, the level of seismic regulation is a function of seismic hazard levels; the cities with the highest risk do adopt the most aggressive mitigation measures. Interestingly however, the level of urbanization is also significant, and the coefficient moderately sized. This means that, controlling for the size of the hazard, urban cities impose more restrictions than suburban and rural areas. The age of housing is not statistically significant for this model, but the association is in the expected direction.

Each of the measures for local economic conditions is statistically significant and positively associated with seismic regulation. This means that the ability of a community to adopt seismic measures is constrained to a certain extent by their level of wealth and prosperity. The coefficients for measures of community wealth and population are similar in size, each reflecting an expected level of influence in the expected direction on seismic regulation. More interesting is the nearly equal influence of economic conditions as reflected through housing pressures. One explanation for this is as an indicator of growth stability. Rapidly growing communities are less likely to be concerned with seismic regulation than communities that have stabilized economically, and low levels of vacancy are generally good indicators of strong and rapid growth.

4.5.4 Political System versus Policy Environment

The final model explores the relative influence of variables at the system level. It addresses the fundamental question of policy output literature discussed earlier, and finds political variables to have the substantially larger impact. Combining political and environment factors into a single model can also obtain a better picture of the true effects of each variable. When influences from other variables are controlled, only the most robust effects remain significant.

Presented in Table 4.5 are the results of the combined analysis. The model overall accounts for 30 percent of the variance in seismic regulation, and is highly significant statistically. Of the explained variance, political factors account for 75 percent, while the policy environment accounts for the remaining 25 percent. This suggests that seismic regulation policy is much more heavily influenced by the political system than by the surrounding policy environment.

Six variables were tested for the policy environment; eight were tested for the political system. An argument advanced by Boyne (1985) suggests that the relative influence of political and environment factors is largely determined by the number of variables tested in each category. He suggests that studies with a greater number of environmental variables find that environment plays the larger role, while studies employing more political measures find in favor of the political system. To address this possibility, a second equation was run, using the five most prominent political variables and the six policy environment measures. The resulting ratios were similar: 65 percent of the explained variance resulted from political factors, compared to 35 percent for the policy environment. These findings clearly demonstrate that for seismic regulation, political influences play the larger role.

Table 4.5 The Combined Model

Political and Environment Influences on Local Seismic Regulation

	Standardized Coefficient	t Statistic
The Political System		
Local Elected Officials		
Understand Building Department functions[a]	.18**	2.7
Involved in Building Department decisions	-.06	-.81
Interest Groups		
Economic Interest Groups[b]	-.11	-1.5
Advocacy Interest Groups[c]	.21**	2.8
Building Department Officials		
Seismic Enforcement Priority Score	.20**	3.0
Number of Seismic Specialists on Staff [d]	.19*	2.1
External Political Influences		
State Requirements	.13*	2.0
Past Disaster	.09	1.4
The Policy Environment		
Measures of Risk		
Seismic Hazard Level (PGA)[e]	.17*	2.1
Level of Urbanization	.05	.53
Percent of Old Housing	.13*	1.8
Economic Conditions		
Long Term Community Wealth	.11	1.3
Housing Pressure	.00	.04
Population (1990) [d]	-.05	-.51
Adjusted R^2	.30	
Significance	p<.001	
Weighted Number of Localities	185	

* p < .05 (one tail test)
** p < .01 (one tail test)
*** p < .001 (one tail test)
[a] variable coding was reversed
[b] architects, engineers, contractors, and homebuilders organizations
[c] historic preservation, environmental, and neighborhood groups
[d] natural log of variable used
[e] square root of variable used

A number of the strongest elements of earlier models remain strong in the combined model. Measures in each category of entrepreneur remain significant, each with a similar size coefficient as before. This suggests that high risk levels and capacity limitations do not significantly diminish the importance of local entrepreneurs. The impact of seismic hazard level, by contrast, drops by nearly a third, and is not nearly as significant as before.

4.6 CONCLUSIONS

The study of public entrepreneurs is a relatively new development in political science. Economists have argued that entrepreneurs are unlikely to be attracted to the public sector because the opportunity for personal profit is fundamentally limited. Yet there is a growing body of evidence that identifies entrepreneurs at all levels of government, and a growing number of testable explanations for their motivations and behavior. The research presented here adds to this literature in two important ways. First, by establishing the impact of entrepreneurial politics on the regulation of public risks; and second, by empirically demonstrating patterns of entrepreneurial influence in local government.

Public risks are frequently characterized by the same collective action problems that plague public goods. The distribution of benefits is too widely dispersed to motivate mobilization by the beneficiaries, but at the same time the costs are concentrated enough to motivate the mobilization of opposition. A number of authors have established the role of the entrepreneur in obtaining public goods. Public risks however, tend to also be characterized by high levels of apathy that add to collective action problems and undermine the effectiveness of entrepreneurial efforts. This research demonstrates that entrepreneurs are just as important for determining seismic policy as for public goods, and that entrepreneurs from within the policy system are particularly effective at achieving their policy goals.

A number of important lessons can be drawn about the role of entrepreneurial politics at the local level, not the least of which is that entrepreneurs are indeed active in local policy systems. We find that local elected officials play a powerful role in shaping the course of seismic regulation in a community, and local building officials even more so. In cities and counties where they are supportive of strong seismic regulation, strong programs are in place. Similarly, we find that interest groups, particularly advocacy groups are a powerful source of entrepreneurs. Although they are not active in all communities, where they are active, seismic regulations are much more likely to be adopted.

We find that entrepreneurial groups are more influential than state mandates, past disasters, local economic conditions, or even the level of risk in the community. Make no mistake, each of these factors plays an important role as well, but none is able to overcome the considerable barriers to adoption without support from one or more categories of entrepreneur.

Many scholars would argue that entrepreneurial politics has become an essential component of the modern political process that seem necessary to balance the scales against powerful, organized opposition. Certainly, important civil rights, worker safety, and environmental legislation in place today could not have passed without the dedicated efforts of these entrepreneurs. Yet despite their importance, we understand little about the conditions that lead to their activation, and even less about their motivation and behavior. This research has sought to uncover some of their place in local politics, and lays the groundwork for future efforts to further examine the peculiar contributions of public entrepreneurs.

Chapter 4 References

Baumgartner, Frank R and Bryan D. Jones 1993. *Agendas and instability in American politics.* Chicago: Chicago University Press.

Boyne, George A. 1985. Theory, methodology and results in political science: The case of output studies. *British Journal of Political Science* 15:473–515.

Burby, Raymond J., and Peter J. May. 1998. Making building codes an effective tool for earthquake hazard mitigation. *Presented at the 1998 Annual Meeting of the Association of Collegiate Schools of Planning, Pasadena, CA.* November 1998.

Burby, Raymond J., Peter J. May, and Robert Paterson. 1998b. Improving compliance with regulations: choices and outcomes for local government. *Journal of the American Planning Association* 64(3) (Summer): 324–34.

Comerio, Mary C. 1998. *Disaster hits home: New policy for urban housing renewal.* Berkeley, Calif.: University of California Press.

Easton, David 1957. An approach to the analysis of political systems. *World Politics* 9:383–400.

Easton, David 1965. *A Systems analysis of political life.* New York, London, and Sydney: John Wiley and Sons.

Jones, Bryan D. 1985. *Governing buildings and building government.* University, Ala.:: University of Alabama Press.

Kingdon, John W. 1984. *Agendas, alternatives, and public policies.* Boston: Little, Brown and Company.

May, Peter J. 1991. Addressing public risks: Federal Earthquake policy design. *Journal of Policy Analysis and Management* 10:263–85.

May, Peter J. 1991. Reconsidering policy design: policies and publics. *Journal of Public Policy* 11:187–206.

May, Peter J., and Thomas A. Birkland. 1994. Earthquake risk reduction: An examination of local regulatory efforts. *Environmental Management* 18 (6): 923–37.

Mintrom, Michael 1997. Policy entrepreneurs and the diffusion of innovation. *American Journal of Political Science* 41: 738–70.

Peterson, Paul E. 1981. *City limits.* Chicago: University of Chicago Press.

Schneider, Mark, and Paul Teske with Michael Mintrom 1995. *Public Entrepreneurs: Agents for change in American government.* Princeton: Princeton University Press.

Schneider, Mark, and Paul Teske 1992. Toward a theory of the political entrepreneur: evidence from local government. *American Political Science Review* 86:737–47.

Shoaf, Kimberley I., and Linda B. Bourque. 1999. Correlates of damages to residences following the Northridge earthquake. *Earthquake Spectra* 15 (February): 145–72.

Wilson, James Q. ed. 1980. *The Politics of regulation.* New York: Basic Books.