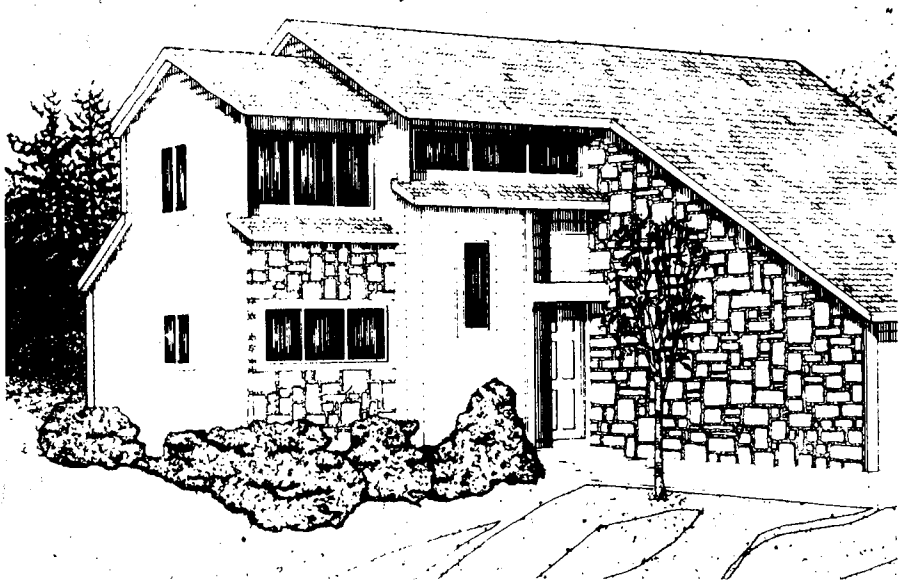
HOME MORTGAGE LENDERS, REAL PROPERTY APPRAISERS AND EARTHQUAKE HAZARDS

Risa I. Palm

et al.



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Risa I. Palm
with
Sallie Marston,
Patricia Kellner,
David Smith,
Maureen Budetti

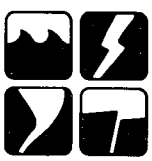

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Figure I-3 is copywritten by the Los Angeles Times, and is reprinted by permission.

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EXECUTIVE SUMMARY

The purpose of this study was to seek a greater understanding of the responses of home mortgage lenders and real estate appraisers to earthquake hazards, given a context of economic and environmental uncertainty. The empirical study involved a survey of 30 California real estate appraisers, 30 mortgage loan officers or other banking executives from the largest lending institutions in the Puget Sound region of Washington, 90 such officers and executives from a sample of lending institutions in the San Francisco and Los Angeles regions as well as statistical analysis of a large data set of characteristics of loan applicants obtained from the California Department of Savings and Loans. Surveys probed individual and institutional responses to the earthquake hazard, as well as possible inter- and intra-institutional conflicts in opinion and policy.

The study's findings show variability in the incorporation of earthquake hazards in lending decisions, with an overwhelming proportion of the smaller lenders in California and most of the Washington lenders tending to ignore earthquake hazards. This survey result is corroborated by the statistical analysis of loan applications which indicates that location within a Special Studies Zone seems to have little or no impact on the lending decision in most California counties.

The report reviews the regulatory environment within which lending institutions operate, and concludes that there are several legal impediments to industry-initiated adoption of hazard mitigation strategies, including federal antitrust laws and state anti-redlining laws. These impediments are not insurmountable, but may slow the adoption of insurance or lending requirements.

Empirical and theoretical literature on the valuation of real estate, the incorporation of hazards in appraisal, and the factors affecting underwriting decisions is reviewed. These studies suggest that real estate appraisers do not claim an active role in property valuation, believing that they reflect but do not affect the market. Lender decisions can be characterized with profit-maximization models based on a calculation of expected revenues from a loan given its opportunity costs and possible associated losses in the event of a default.

The survey of appraisers showed that appraisers will supply earthquake hazards information to clients, but only when asked. However, appraisers generally do not feel that environmental hazards can or should be isolated from the many other variables that contribute to property value. They also tend to view earthquake hazards as having a negligible effect on value.

The lender survey showed variety in both the perception and response of home mortgage lenders to earthquake hazards. Some of California's lenders note seismic hazard in the lending decision and use seismic information in setting loan conditions. Their response is usually to avoid loans in particularly hazardous areas or to require that homebuyers purchase earthquake insurance. These lenders tended to be from the larger institutions, and many had attended earthquake hazards seminars.

The analysis of loan applications indicated that lenders act more favorably on loan applications for new housing, for owner-occupied property, when borrowers are Anglo rather than Hispanic or Black, and when there is a relatively high income to sales price ratio. Location of the property in a special studies zone is generally unrelated to the lending decision.

CHAPTER I THE PROBLEM

Earthquake Hazards in California and the Puget Sound Region

In the United States as a whole, 39 states with a combined population of 70,000,000 are estimated to be at risk from earthquake hazards (NEHRP,1982). A single major earthquake could cause up to $50 billion in losses, with serious casualty levels and disruption of community life. The states of California and Washington account for a combined rate of over 75% of the average liability losses per event for the entire United States, with California alone representing 67.3% of this total (Wiggins, 1980, p. 76).

In California three "great" earthquakes of magnitude (M) 8.0 or greater have occured since 1857 (Figure I-1). The last of these was the 1906 event along the San Andreas fault. Since major population growth has occurred on both the northern and southern portions of the San Andreas fault since then, it is expected that the next such earthquake will cause catastrophic losses of life and property.

The Federal Emergency Management Agency has published some conclusions about a major damaging earthquake in California (Federal Emergency Management Agency, 1981). A magnitude 8.3 event has a moderate probability of occurrence in the next 20 years in northern California, causing $38 billion in property losses, and killing between 3,000 and 11,000 people, depending on the time of day it hits (Figure I-2). In Southern California, such an earthquake has a high likelihood of occurrence in the next 20 years, and would be accompanied by a $17 billion property loss and 3,000-14,000 deaths (Figure I-3).

Although the Puget Sound has been affected by several major earthquakes in the past 120 years, they are neither as frequent nor as

FIGURE I-1

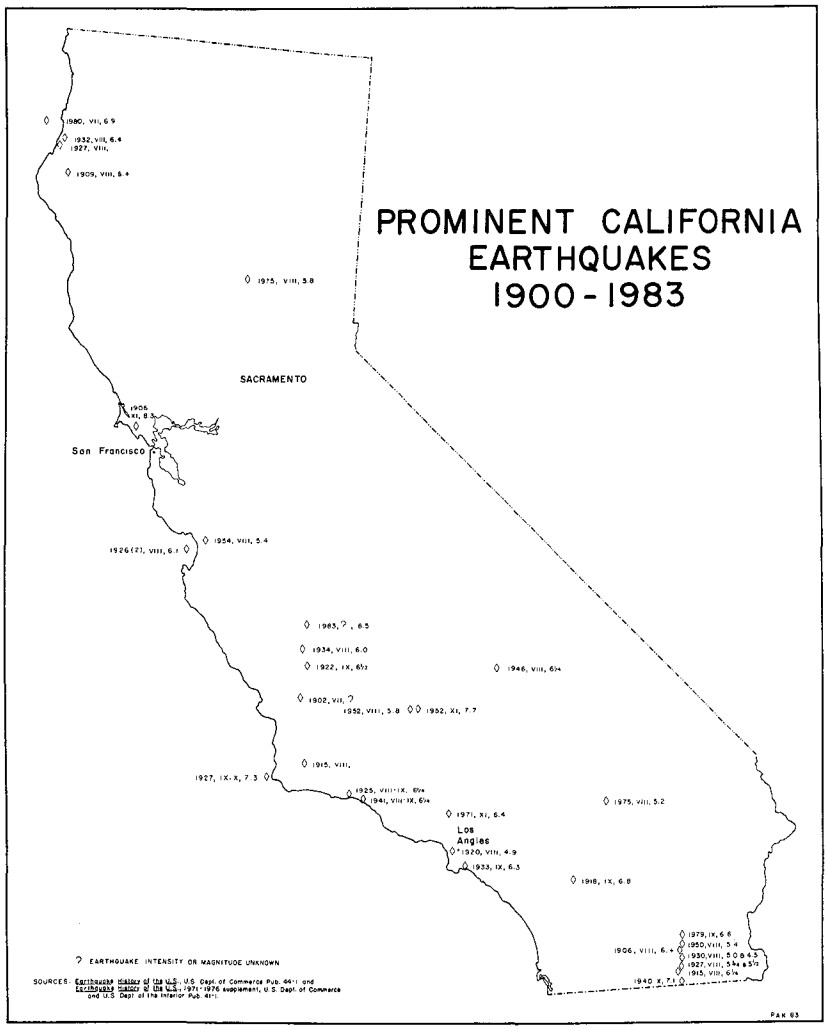
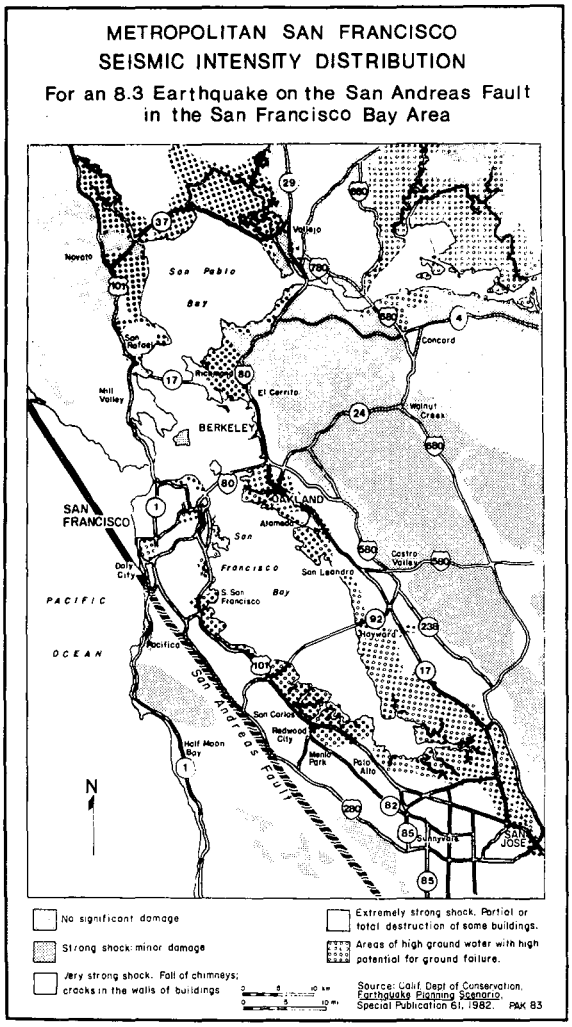
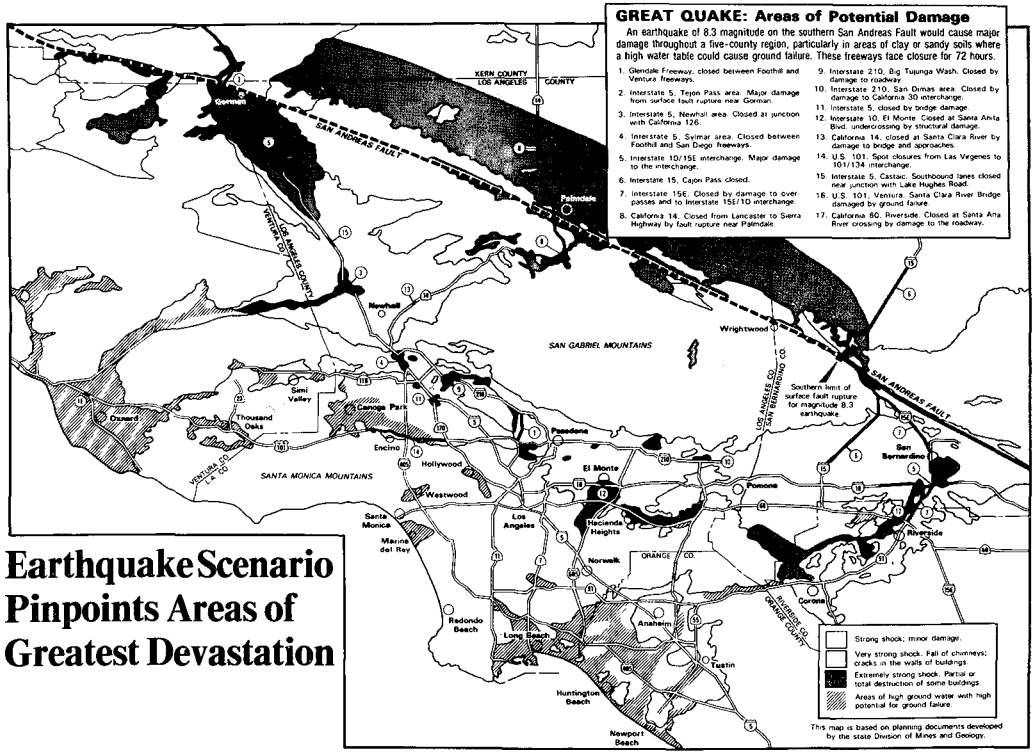

PROMINENT CALIFORNIA
EARTHQUAKES
1900 - 1983
1980, VII, 6.9
1932, VIII, 6.4
1927, VIII,
1909, VIII, 8.4
1975, VIII, 5.8
SACRAMENTO
1906
XI, 8.3
San Francisco
1954, VIII, 5.4
1926(?), VIII, 6.1
1983,?, 6.5
1934, VIII, 6.0
1922, IX, 6½
1946, VIII, 6¼
1902, VII, ?
1952, VIII, 5.8
1952, XI, 7.7
1915, VIII,
1927, IX-X, 7.3
1925, VIII-IX, 6¼
1941, VIII-IX, 6¼
1971, XI, 6.4
1975, VIII, 5.2
Los
Angles
1920, VIII, 4.9
1933, IX, 6.3
1918, IX, 6.8
1979, IX, 6.6
1950, VII, 5.4
1930, VIII, 5.0 & 5.3
1927, VIII, 5¼ & 5½
1915, VIII, 6¼
1906, VIII, 6.+
1940, X, 7.1
? EARTHQUAKE INTENSITY OR MAGNITUDE UNKNOWN
SOURCES: Earthquake History of the U.S., U.S. Dept. of Commerce Pub. 64-1 and
Earthquake History of the U.S., 1971-1976 supplement, U.S. Dept. of Commerce
and U.S. Dept. of the Interior Pub. 41-1.
PAH 83

FIGURE I-2


METROPOLITAN SAN FRANCISCO
SEISMIC INTENSITY DISTRIBUTION
For an 8.3 Earthquake on the San Andreas Fault in the San Francisco Bay Area
Novato
San Pablo Bay
Vallejo
Concord
San Rafael
Richmond
El Cerrito
Mill Valley
BERKELEY
Walnut Creek
OAKLAND
SAN FRANCISCO
Alameda
San Francisco Bay
San Leandro
Castro Valley
Daly City
S. San Francisco
Hayward
PACIFIC OCEAN
Pacifica
San Andreas Fault
San Carlos
Redwood City
Menlo Park
Palo Alto
Half Moon Bay
Sunnyvale
SAN JOSE
N
No significant damage
Strong shock: minor damage
Very strong shock. Fall of chimneys; cracks in the walls of buildings
Extremely strong shock. Partial or total destruction of some buildings.
Areas of high ground water with high potential for ground failure.
Source: Calif. Dept of Conservation, Earthquake Planning Scenario, Special Publication 61, 1982. PAK 83



Earthquake Scenario Pinpoints Areas of Greatest Devastation

FIGURE I-3

intense as those in California. The largest earthquakes with epicenters in the Puget Sound region occurred in 1949 and 1965 (Figure I-4). The 1949 earthquake had its epicenter between Tacoma and Olympia and was a magnitude 7.1 event. It inflicted property damage of about $25 million in 1949 dollars. The 1965 earthquake was a magnitude 6.5, with an epicenter between Seattle and Tacoma. Property damage was estimated at $12.5 million (1965 dollars).

Awareness of the earthquake hazard is high in both states. Drabek *et al.* (1983) found that virtually all of their respondents in Washington felt that a major earthquake is likely to occur in the next 50 years, with 88 percent indicating that it was "very likely". As might be expected, California residents are also highly aware of the earthquake hazard. Turner *et al.* (1979) found that a full 43 percent of Los Angeles respondents expected a major damaging earthquake to occur "within a year" in 1977, following the many predictions of 1976 and 1977 as well as popular writings about the Palmdale bulge. However, as has been stated repeatedly, awareness is not necessarily followed by the adoption of mitigation measures, either by individuals or by institutions (Nigg, 1982; Saarinen, 1982; Bauman, 1983)

The purpose of the research reported here was to study the responses of a very influential portion of the population -- home mortgage lenders -- to earthquake hazards in California and the Puget Sound region of Washington. The study was designed to document the practices of lenders in incorporating earthquake hazards in their portfolio analysis and lending behavior. It is argued that lenders play a key role in the settlement of areas and the exchange of property, and are worthy of close scrutiny as urban managers.

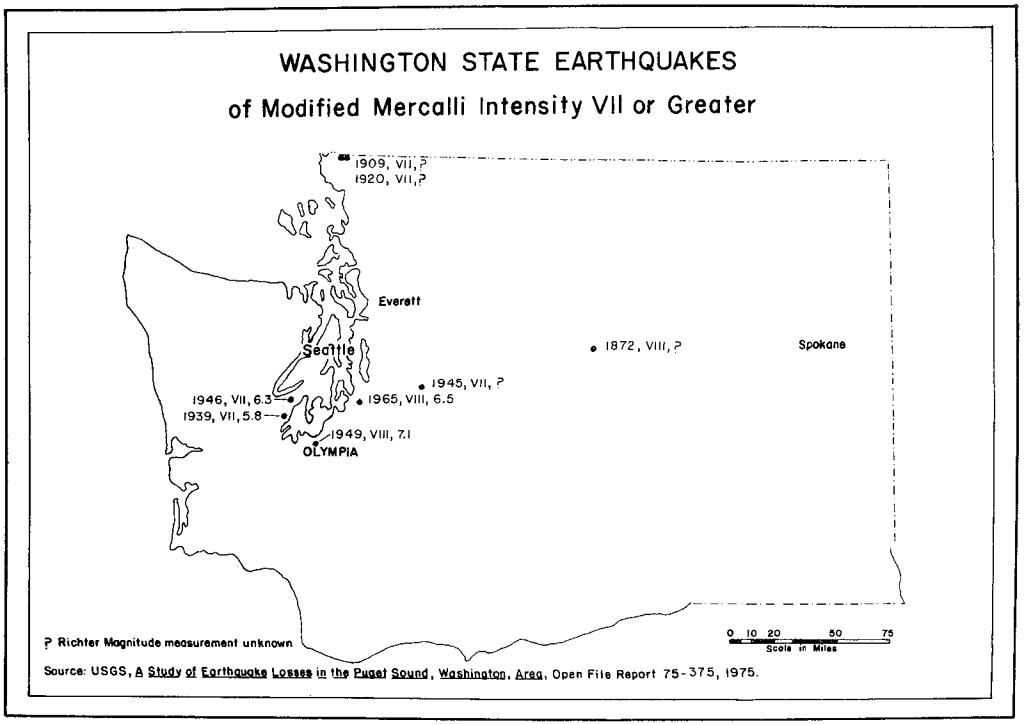

WASHINGTON STATE EARTHQUAKES
of Modified Mercalli Intensity VII or Greater
1909, VII, ?
1920, VII, ?
Everett
Seattle
1872, VIII, ?
Spokane
1945, VII, ?
1946, VII, 6.3
1965, VIII, 6.5
1939, VII, 5.8
1949, VIII, 7.1
OLYMPIA
? Richter Magnitude measurement unknown
0 10 20 50 75
Scale in Miles
Source: USGS, A Study of Earthquake Losses in the Puget Sound, Washington, Area, Open File Report 75-375, 1975.

FIGURE I-4

Why Study Home Mortgage Lenders and Appraisers?

Home mortgage lenders have a very important effect on the access of households to neighborhoods. Through their willingness or reluctance to finance housing for various populations or in various areas, they can essentially control access to the occupance of areas for that very large portion of the population dependent on home mortgage financing. Financial institutions have been dubbed "gatekeepers", meaning that they can effectively control access of households to entire areas of the city or portions of the housing market (Leven *et al.*, 1975; Darden, 1977; Williams, 1978; Pahl,1975; Palm, 1979). Some research has gone so far as to charge that decisions made by financial institutions can affect the very stability of portions of the city (Stegman, 1972; Harvey and Chatterjee, 1974; Stegman, 1972; Bradford and Rubinowitz, 1976; Senate Committee on Banking, Housing and Urban Affairs, 1975).

Real estate appraisers too have been considered key figures in access to housing. Although appraisers claim that they are passive in the house valuation process, merely reporting on values set "by the market", it has been charged that appraisal practices can perpetuate or accentuate the importance of certain factors in housing valuation which may work to the disadvantage of certain housing types or groups of buyers ("Justice Department . . .," 1976). Appraisers are an integral part of the home mortgage financing process in that at least one appraisal is involved in each financing decision, and several appraisals (for the seller, the buyer, and the lenders) may be involved in a single transaction. The interactions of the perceptions and assessments made by appraisers as well as lenders are therefore highly significant.

The school of thought emphasizing the role of real estate institutions as gatekeepers has been generally termed "urban managerialism". This perspective came under considerable criticism, particularly in England, where studies of financial institutions, real estate agents, and urban planners had a brief flurry of activity and then generally fell into disrepute (Pahl, 1975; Gray, 1976; Saunders, 1979). Among the criticisms of this perspective were the lack of a conceptual basis for the selection of which urban manager should be studied, the lack of an interpretation of the influence of managers in a holistic sense, and the tendency for such studies to analyze the selected manager as an autonomous unit rather than as part of the general nature of the urban political-economic structure (Bassett and Short, 1980). More recently, it has been argued that the study of urban managers should be resumed, not merely any longer to describe the outcomes of their individual actions, but more generally to understand the individual and organizationial forces which affect and respond to the overall societal structure (Williams, 1982).

A study of urban managers in a theoretical framework provided by the *structuration* perspective (Giddens, 1979; 1981) sheds light on the use and interpretation of the environment itself, and the role of given institutions in a particular time-space setting. Williams (1982, p. 104) has argued that the study of urban managers, cast within the perspective of structuration, leads to a more complete understanding "of the processes at work, the way they form and change," which, in turn, helps to "explain the realities of social actions".

In the theory of structuration, there is particular emphasis on the mutuality of cause and effect between agency (individuals) and structure (environment). The environment or "locale" includes a

connotation of social structure, where the setting is both a scene or backdrop, and is also a situation which is actively organized and changed by the participants (Giddens, 1981, p. 161). Individuals are affected by the organization of the social and economic environment, but are also active in changing "the conditions of life that others seek to thrust upon them" (Giddens, 1981, p. 172). In this sense, urban managers are important both as individuals responding to their environment, and as key participants who structure the environment for others. For their own households, they participate in home purchase and locational decisions which may make them susceptible to environmental hazards. Their decisions in this respect are much like the decisions of other homebuyers, with the possible exception that they may have more personal resources with which to obtain mortgage financing and more knowledge of economic trends in portions of the metropolitan area.

But urban managers have another role. They make decisions not only affecting their own household and its connections with neighborhood and community, but also having far-reaching implications for other households and the entire institutional structure. Because urban managers may act as "bottlenecks" through which individual actions are filtered and institutional structures become translated or enforced, they play an especially important role in modifying the structure or institutions, as well as communicating and in some cases creating the constraints and opportunities which the economic/social environmental structure sets for individuals. It is this bridging or filtering role which makes their perceptions and behavior of such

interest to those wishing to understand the interactions between individuals and the environment.

Home Mortgage Lenders and Environmental Uncertainty

The purpose of this study was to gain a greater understanding of the perceptions and behavior of home mortgage lenders in a context of environmental uncertainty. The environmental setting for the study was one in which housing is largely bought and sold in a market highly dependent on credit. Access to this housing is limited by decisions made by those who give or withhold this credit -- the home mortgage lenders. The home financing industry is dominated by a few types of institutions and an ever smaller number of these institutions which have a virtual monopoly on credit decisions and credit allocations.

The economic environment contains some uncertainty, based partly on a recent history of disintermediation (the flow of funds away from mortgage capital markets) associated with high interest rates, economic recession, and government regulations concerning conditions under which the mortgage lenders could offer returns on money invested (e.g. limitations on interest rates for demand deposits), and also based on the uncertainty inherent in any credit transaction. In the particular setting of the study there is another major source of uncertainty: the question of when a major earthquake will damage or destroy a large proportion of the real assets on which the portfolio of the lending institutions is based, and the kinds of institutional responses to this major disaster which may be available to mitigate some of the more devastating consequences of such an event.

The research focusses on the response of home mortgage lenders to the additional uncertainty of using as collateral for loans houses in areas particularly vulnerable to seismic events. The analysis probes

not only the individual perceptions and behaviors of the loan officers, but also the role of inter- and intra-institutional conflicts and competition in affecting the behavior of the loan officers, and the ways in which this system of credit allocation seems to be evolving.

The home mortgage lending officer could act as an interpreter of the availability of mortgage credit on environmentally hazardous property to prospective residents. At present, buyers have no mechanism to systematically inform them about the nature and significance of environmental hazards, and no institution to guide them in taking mitigation measures. Prospective residents are therefore left on their own to make decisions about accepting environmental risks. Although it is true that the Alquist-Priolo legislation in California requires real estate agents to disclose to homebuyers the fact that a given property is within a surface fault rupture zone, this disclosure has been shown to be ineffective as a means of transmitting environmental information (Palm, 1981). Furthermore, the zones themselves are not and were never intended to be an approximation of the area particularly liable to earthquake damage, in that they exclude areas susceptible to liquifaction and ground failure. It is therefore not surprising that despite the active role of the state Seismic Safety Commission, the Southern California Earthquake Preparedness Project, and a variety of public education campaigns, survey research has shown that few Californians have purchased earthquake insurance or taken significant mitigation measures (Turner *et al.*, 1979; Palm, 1979; Kunreuther *et al.*, 1978).

It has been argued that homebuyers are not irrational in their response to earthquake hazard. If one looks at only a three- to five-year future occupance of a property, it is perhaps economically

rational to overlook earthquake hazards expressed for a 30 to 50-year time-frame, and not to purchase insurance, invest in structural reinforcements, or take other costly mitigation measures. This argument looks different from the perspective of the holder of a mortgage loan, however. It would appear that institutions with long-term financial interests in a given parcel might be concerned with susceptibility to damage from surface rupture, shaking, sliding, or liquifaction, particularly during the early years of the life of the loan. If institutions, through their loan officers, did express such a concern, it would be translated into at least an awareness on the part of the prospective homebuyers that seismic risk was a real threat, such an awareness would probably manifest itself in the avoidance of certain housing by some portion of the homebuying public, or the more widespread adoption of mitigation measures.

The research problem investigated here has both theoretical and policy-relevant aspects. A theoretical framework for interpreting and recasting the research question on the role of urban managers is that of "structuration," a conceptualization which allows one to note the way in which home mortgage lenders as urban managers articulate the interactions of individual homebuyers and an uncertain and hazardous physical environment. From a policy standpoint, the research relates to the ways in which prospective residents can best be informed about the risks to life and property they incur in electing to purchase homes in areas deemed especially hazardous. This second point deserves some elaboration.

There are several possible means of persuasion which the state could use to regulate the use of land in hazardous areas. However, given the political-economic ideology of the contemporary United

States. and especially the place of land acquisition within the ideology of privatism, it is unlikely that land use regulations could practically be adopted. In addition, the regulation of hazardous areas through the purchase of land and disposal of existing structures would seem draconian at worst, and at best would be considered an expensive option that would be unlikely to gain the political support necessary for adoption. Instead, it would be preferable to turn the possible self-interest of lenders into an effective information system in which prospective residents would be better informed of the risks concomitant with certain locations. For example, if lenders were to require earthquake insurance as a condition for obtaining a mortgage loan, as is the case with unsubsidized fire insurance universally, and in most communities with subsidized and unsubsidized flood insurance, then both lenders and buyers would be protected from financial losses associated with earthquakes. Or, if lenders showed a reluctance to make uninsured loans in areas particularly susceptible to earthquake-related damage and told buyers of the reasons for their reluctance, an efficient information system would be put into place without the need for further government regulation.

The policy-relevant aspect of this research is to investigate some of the aspects of this possible correction in the current system of environmental assessment by homebuyers and mortgage lenders. Better environmental assessment by mortgage lenders would result in at least some attempt to prevent major financial crisis both for individuals and institutions in the event of a severe damaging earthquake. If such a system can be incorporated into the ongoing practice of credit-financing of housing, then an important protection can be put in place for residents of earthquake-prone areas without facing the costs and

the political opposition inherent in policies more dependent on regulation.

In the next two chapters, the legal and decision-making contexts within which lenders work will be outlined. The interaction of individual loan officers with this context will be explored in chapters 4 and 5 through a report on surveys of residential real estate appraisers and loan officers in Washington and California. Finally, both the theoretical and policy implications of the survey results and their interpretations will be presented.

CHAPTER II THE REGULATORY ENVIRONMENT

Home mortgage lending institutions operate within a highly regulated environment. First, general economic conditions have a major impact on the behavior of lending institutions. For example, changing interest rates and investment opportunities affect the initial portfolio decisions of lenders; in periods of high interest rates, short-term investments may be more profitable, which could result in a curtailment of investment in fixed, long-term investment in housing.

Second, in order to increase the amount of funds available for mortgage investment, home mortgage originators (lenders) frequently resell groups or "packages" of mortgages to investors. The buying and selling of these mortgage packages is what is known as the *secondary mortgage market*. Institutions and organizations may purchase packages of mortgages, and in turn sell shares in these packages. Such organizations include government and quasi-government organizations such as the Federal Home Loan Mortgage Corporation (Freddie Mac), the Federal National Mortgage Association (Fannie Mae), and the Government National Mortgage Association (Ginnie Mae), as well as large investors such as insurance companies and pension funds. These secondary market purchasers often influence mortgage lending terms (Morrow-Jones, 1983; Tuccillo *et al.*, 1982; Hendershott *et al.*, 1980). For example, if the Federal Home Loan Mortgage Corporation were to require earthquake insurance on packages of mortgages originated on California property, the originators would be strongly encouraged to require earthquake insurance as a loan condition in order to be able to resell the mortgages. Decisions made by large secondary mortgage purchasers, therefore, have a major impact on the behavior of commercial banks and savings and loans, the primary loan originators. To date, few

secondary purchasers have responded to seismic risk in their criteria for the purchase of mortgages, but this source of influence could have a significant effect in changing the policies and practices of mortgage originators.

Federal and state regulations also limit the activities of home mortgage lending institutions in many ways. In the past, these have included requirements concerning the percentage of the portfolio that must be invested in local home mortgage loans for federally-chartered savings and loans, and a maximum interest rate that is permitted on demand deposits, which was said to inhibit the competitive ability of commercial banks and savings and loans to attract short-term savings funds, other requirements include those concerning liquidity and the enforcement of fiduciary responsibility through periodic examinations by the Federal Reserve Bank Board, the Federal Savings and Loan Insurance Corporation, and the Federal Deposit Insurance Corporation, and the Federal Home Loan Bank; regulations requiring the disclosure of the geographic area in which home loans are made; and regulations concerning the disclosure of the full cost of borrowing money. It is safe to say that national commercial banks and federal savings and loan corporations are highly regulated.

Regulations Affecting Loans in Seismically Hazardous Areas

Lending institutions are exhorted, and indeed required, to demonstrate fiduciary responsibility; they are required to maintain a certain liquidity, and to make lending decisions which are sound enough not to place investor's funds at undue risk. In exchange, lenders can provide the promise of insured savings, encouraging the cautious investor to place at least some portion of his/her surplus funds in the financial institution.

Lenders are also required to take account of areas susceptible to flooding in their mortgage loan procedures. The Federal Deposit Insurance Corporation (FDIC) and the Federal Home Loan Bank Board require member institutions to obtain from borrowers "written acknowledgement that the borrower realizes the property securing the loan is or will be located in an area identified as a flood hazard area and the borrower has received the required notice regarding the Federal disaster relief assistance" before the loan is closed (12 C.F.R.#339.6 (a); 12 C.F.R.#523.29 (e) (1981). In addition, banks which are members of FDIC must require flood insurance on any loans made, increased, extended, or renewed if the property is located in a designated flood hazard area.

Lenders also routinely protect their own investments by requiring title insurance specifying the nature of liens on the subject property, and homeowner's insurance covering at least the balance of the mortgage should the house be destroyed by fire. Insurance against certain other hazards, however, is usually left to the discretion of the homeowner, and regulatory agencies have made no requirements or recommendations about such insurance. What this means is that despite general exhortations concerning fiduciary responsibility, the regulatory agencies have remained silent about the practice of making uninsured loans in areas of high seismic risk. In addition, federal and state laws intended to effect other purposes may actually hinder financial institutions which might wish to take action to reduce their susceptibility to earthquake related losses. These restrictions deserve some elaboration.

Unintended Impacts of Other Regulations

Two major areas of state and federal law seem to limit the possibility of industry-initiated insurance requirements or other

uniform loan modifications in areas of high seismic risk. These laws include the set of legislation summarized as antitrust law, and the state and federal anti-redlining laws covering both insurance underwriting and mortgage origination.

Antitrust Laws

Antitrust law has a long history of enactment of regulatory details and interpretation of case law. Provisions relevant to the subject at hand are contained in the Clayton Act, the Sherman Act, and the Federal Trade Commission Act. Violations of these acts include activities involving price-fixing, and "tie-in" agreements which condition the sale of one item to the purchase of another. Conspiracy or collusion can be proved under the Sherman Act by evidence of parallel actions which have followed communication between the principals, even if the actions were subsequently adopted separately. Brown and Weston (1981) have argued that making the availability of mortgage funds contingent on borrowers obtaining earthquake insurance may be in violation of antitrust legislation if adopted on an industry-wide basis. Since collusion is proved circumstantially, it would be very difficult to defend against a charge of collusion if, after discussion, a large number of home mortgage lenders adopted similar policies:

> To encourage earthquake hazard reduction, mortgage lenders may refuse funds unless adequate earthquake insurance is obtained by property owners, *or* seismic building standards are available and enforced in a locality. If such an action is taken by individual lenders without prior agreement or collusion with others, the antitrust risk is low. If, however, the action is taken in a collusive manner (communications among competitors, followed by parallel conduct, for example) it would probably be in violation of the Sherman Act (Brown and Weston, 1981, p.9).

In short, the requirement of earthquake insurance or any other industry-wide measure that would systematically restrict access to mortgage funds following intra-industry agreements would very likely

subject the lending institutions to charges of antitrust violations, with serious legal consequences. It would be possible, however, to reduce lender fear of antitrust problems by enactment of a Congressional exemption, or through the non-binding Advisory Opinions issued by the Federal Trade Commission or the Business Review Letters issued by the Department of Justice. Some such action will be necessary if lending institutions are to be reassured that such industry-wide agreements are legally feasible.

Antiredlining Laws

State and federal legislation designed to make home mortgage funds available to individuals regardless of age, sex, race, or ethnic background, have the unintended and undesirable effect of preventing insurance companies from setting rates reflecting the very real geographic variations in exposure to risk, and preventing home mortgage originators from using environmental characteristics as criteria in mortgage loan decisions. The legislation was designed to prevent the practice of avoiding insurance underwriting and home mortgage financing in neighborhoods considered to be a poor risk, a decision which used to be based on several factors including the presence of large numbers of renter-occupiers, changing racial composition, or visible signs of deterioration. Since it was charged that this practice contributed to the further deterioration of redlined neighborhoods, and was usually applied to neighborhoods inhabited by lower-income households, or racial minorities, the federal government enacted a series of regulations prohibiting discriminatory lending policies. In addition, the District of Columbia and five states (including California) passed even more specific anti-redlining legislation.

Although it would be in the home insurer's best business interests to differentiate insurance premiums in accordance with known

systematic variations in risk, such action is precluded by Executive Order 11063 barring credit discrimination and by other anti-redlining legislation. Homeowner's insurance can be adjusted only for the percentage of the face value covered by the insurance, the length of time covered by the insurance, and the loan-to-value ratio. Any other adjustments are considered discriminatory. Masulis (1982) has argued that such anti-redlining legislation discourages both loan origination and also the availability of homeowner's insurance in high risk areas. Although earthquake-prone areas have not seen either a withdrawal of mortgage funds or a lack of availability of homeowner's insurance to date, it is conceivable that both conditions would eventuate:

> In areas with high probabilities of hazard, insurers actually refuse to offer insurance coverage. In part, this is due to municipal and state insurance regulators having placed or threatening to place explicit or implicit ceilings on premiums combined with a prohibition against selective cancellation of policies where these regulations are justified on the basis of alleged price discrimination by hazard insurers (p. 208).

In short, because of regulations prohibiting variations in insurance rates, particularly in areas populated by low-income and minority households, the insurance industry loses incentives to provide these areas with homeowner's or hazard insurance. The eventual result of these regulations is a lessened availability of mortgage financing, despite legislation designed to increase the flow of mortgage credit funds to such areas.

The entire topic of homeowner's insurance coverage for earthquake-related hazards has been thrown into at least temporary turmoil by a series of California state court decisions, including an appellate court decision in 1982 that if there are concurrent causes of damage associated with a seismic event (for example negligent construction combined with ground shaking or land failure), the ordinary homeowner's policy is in effect, even despite explicit

earthquake exclusions. The final court resolution has not yet been reached on this issue, and it is possible that insurance policies will be substantially rewritten in California, or rates will be dramatically altered in the next few years.

Lenders too are prohibited from discrimination in the setting of lending conditions. In California, the financial institution must demonstrate "that such consideration in a particular case is required to avoid an unsafe and unsound business practice," which is strictly defined as a decrease in the value of the property in the first *three to five years* of the mortgage term (Cal. Admin. Code tit. 21, R. 7105 (a) (1) (D) (1979) and R. 7106 (B) (1) (1979). Since seismologists are not presently able to make precise earthquake predictions for a particular parcel within a five-year period, location in an area subject to seismic risk does not in itself seem to be sufficient grounds for loan refusal or modification of lending terms. As Palm and Corbridge (1982-83, p. 346) have demonstrated:

> California law, intended to assure access to mortgage credit by persons formerly subject to discriminatory lending practices, has the unintended effect of guaranteeing that property susceptible to damage within the thirty-year life of the mortgage must still get access to mortgage financing on the same terms as property not so situated.

The state Housing Financial Discrimination Act seems to bar a requirement of earthquake insurance or the addition of any other loan modifications, if this is done for some neighborhoods and not others. Even though micro-zonation has been completed for the Los Angeles region and for the San Francisco Bay area (Davis *et al.*, 1982), the use of this information as a basis for discriminating among areas in loan decisions or in setting loan conditions seems to be prohibited.

In sum, regulations seem to limit the adoption of certain earthquake hazard mitigation measures in the financing or insuring of

residential property. Anti-trust legislation prevents any hint of collusion in the setting of terms such as earthquake insurance requirements, and anti-redlining legislation prevents insurers and mortgage lenders from making systematic neighborhood distinctions.

Summary

Although home mortgage lenders are in a pivotal position in affecting access to housing through their role in converting capital into mortgage credit, they are also highly regulated. Their actions are strongly affected by institutions to whom they sell packages of mortgages, the secondary mortgage market. Any new terms set by such purchasers of mortgages have an immense effect on the loan conditions mortgage originators will demand. More formal regulations also limit the activities of mortgage lenders -- regulations emanating from federal agencies and commissions, state commissions and boards, and also from legislation which may have been designed for purposes other than those on which they have an impact.

It would be naive to envision the financial community as passively controlled by such regulations, given the very strong banking lobby at the national and state levels. Some of the regulations affecting banking practice have been sponsored by the banking community, and most have at least the tacit approval of large numbers of financial institutions. In addition, the financial community has had an active role in changing regulations when they become overly restrictive or impede profitable business practice, as witnessed by the efforts to curb the competing money market funds in the early 1980's, efforts to halt proposed IRS withholding on interest and the success in changing regulations concerning variable interest rates and account terms to permit savings and loans to attract more funds.

Existing legislation does limit the scope for adopting new business practices, and should be noted as we consider the factors that affect lending decisions and the ways in which conditions for home loans are set. The requirement of earthquake insurance as a condition for home mortgage loans would face certain legal barriers, although these are not insurmountable. However, the barriers currently in effect may account for some of empirical observations discussed in Chapter V.

CHAPTER III DECISION MAKING BY LENDERS AND APPRAISERS

The purpose of this chapter is to set the decision-making patterns of appraisers and lenders in context. To do this, models of rational decision making will be examined. The role of physical characteristics of site in the normative decision-making process will be presented. This framework can then be used as a standard against which empirical observations of appraisal practice can be assessed.

The Valuation of Residential Property

Real estate appraisers use three methods to assess the value of single family residences: the market data or comparable approach, the cost method, and the income approach. A combination of these three methods results in an estimate of market price, which is, in turn, fundamental to purchase and lending decisions.

The market data or comparable approach to valuation is commonly used by real estate agents as well as professional appraisers in estimating the probable price of single family owner-occupied residential dwellings. Using this approach, the appraiser finds comparable properties sold in recent years, analyzes each comparable property with respect to time of sale, size and features of the dwelling unit, location in the neighborhood, physical characteristics of the lot, and conditions of sale. The appraiser then compares the subject property to the "comparables," making price adjustments for each differentiating feature, and derives an appraised value for the subject property. House price (or exchange value) is actually the result of the direct actions of sellers and buyers. Since the market data approach reflects the exchange value rather than that implied in construction or land costs, this approach is considered the most acceptable in the appraisal of residential property. It is less

effective in sparsely settled areas or in those with very inactive housing markets, where comparables are difficult to assess reliably.

The cost method of appraisal estimates the value of the site when vacant (based on sales of comparable sites), the current cost of reproducing existing structures (improvements), the total depreciation on the improvements based on physical deterioration, functional obsolescence (reduced desirability of architectural style or layout, or of particular materials or equipment), and economic obsolescence from factors external to the property itself. This approach is often used in conjunction with the comparable approach in residential property appraisal.

The third method of valuation is the income approach. Valuation is based on the income that the real estate could earn if it were rented. This method has limited application in predominantly owner-occupied areas.

In recent years, the market data approach has been modified by the use of regression analysis, sometimes known as "hedonic price" estimates. These estimates require extensive and relatively current data on recent house sales throughout the housing market being investigated. Using a series of independent variables, including descriptors of neigborhood type, the lot, and the dwelling unit, an estimated price is computed for a combination of variables. The individual regression coefficient is then interpreted as an implied value for each descriptor. For example, if the average price in a housing market is $90,000, and the average house contains 2000 square feet of finished space, an implied value can be obtained for each additional square foot of finished space, or similarly the presence or absence of certain amenities such as fireplaces or swimming pools.

Similarly, the negative impact of disamenities, such as poor insulation or location in a hazardous area, can also be computed.

Standard texts (Bloom and Harrison, 1978· Ratcliff, 1965; and Hines, 1981) instruct appraisers on the separate analysis of the improvements (dwelling units), the site (lot), and the location or neighborhood. Let us review briefly what appraisers are taught to look for in the process of real estate appraisal. With respect to the dwelling unit itself, home mortgage insurers (such as the Federal Housing Administration) and secondary mortgage market institutions have standardized the list of factors to be considered in an appraisal. The FHA underwriting manual requests a six-point rating for the purpose of home mortgage insurance based on (1) visual appeal of the property, (2) liveability, (3) natural light and ventilation, (4) structural quality, (5) resistance to the elements (rain, snow, etc.) and (6) suitability of mechanical equipment. In addition, the rating of the property is adjusted for nonconformity -- the extent to which there are local inharmonious mixtures of land use. The residential appraiser should include a description and an analysis of the following features: the site improvements (grading, drainage, landscaping, public utilities, lighting, the presence of sidewalks and curbs, water and sewage systems, driveways and parking places), the relationship of the improvements (house) to the site (e.g. location on the lot, extent of privacy), a general description of the house (number of rooms, living area, car storage), a description of the exterior (assessment of framing, ventilation, windows, chimneys), a description of the interior including an evaluation of general construction, an assessment of mechanical systems such as the heating, cooling, plumbing, electrical and hot water systems, items in need of repair, the overall condition of the house, and the functional utility (design and layout) of the

house, including the division of the house into sleeping. social and service zones, and deficiencies in the floor plan.

Both the physical characteristics and the environment of the lot or site are to be evaluated in this section of the appraisal report. The physical description indicates the dimensions and shape of the lot, its topography and elevation (susceptibility to flooding), soil and subsoil conditions, site improvements (water, gas, sewer and electric hookups), views, street improvements (gutters, lighting), site improvements (fences, recreational facilities), hazards, nuisances (fire stations or schools that are next door, high tension wires, vacant properties), and climatic or meteorological conditions (strong winds). In the category of hazards, one text states:

> Sometimes hazards exist in the neighborhood that reduce the value of a property. The most common hazard is heavy traffic, and the market will definitely recognize and penalize this problem. The awareness of flood hazards has become quite important in many parts of the country now that many lenders cannot issue a mortgage in a flood hazard area without flood insurance . . . The effect [of flood hazards and mandatory flood insurance] on value must also be considered and reported in the appraisal. Other hazards that should be investigated include potential slides, earthquakes, dangerous ravines and bodies of water, or any unusual fire danger (Bloom and Harrison, 1978, pp. 124-5).

Two points are of interest in the above quotation. First, is the implicit notion that it is not the appraiser who is taking an active hand in valuation but rather "the market," which in this paragraph is reified to enable it to "recognize" and "penalize" a problem. The second point is the significance of flood hazard insurance in affecting real estate appraisal practice, and the admonishment to take other natural hazards, including earthquake hazards. into account in the appraisal.

At the neighborhood level, appraisers are taught that a set of physical/ environmental, social, economic and governmental variables affect the value of an individual residential property (Bloom &

Harrison, 1978). Physical or environmental factors include: the location of the neighborhood with respect to the larger community or city (is it close to the central business district? close to areas of high crime?); sharp barriers or boundaries to both define and protect the neighborhood such as rivers, highways or parks; topography (value tends to rise with proximity to a lake or river, in areas protected from the wind or fog or flood, in areas with good views, at elevations higher than surrounding neighborhoods, and in rolling countryside); its ability to bear stuctures and support landscaping; drainage,or susceptibility to flooding; availability of utilities; proximity to services such as schools, public transportation, shopping and recreation facilities; street pattern layouts (curving streets, cul-de-sacs, and slow-moving traffic increase value); land use patterns (the extent to which different land uses are separated and buffered through zoning and deed restrictions); conformity of structures (absence of widely diverse styles and upkeep); appearance of the neighborhood (landscaping, and well-kept homes increase value), nuisances and hazards (traffic congestion, smoke, or noise from nearby airports detract from value); and age and condition of housing in the neighborhood overall. Social factors include population characteristics (although appraisers are now carefully warned that racial composition or mixture is not necessarily relevant to value), the existence of neighborhood or community associations (such as associations controlling recreational facilities or providing security and other services), and the crime level of the neighborhood. Economic factors affecting value include the relationship of the neighborhood to overall growth in the urban area (is it in the path of expansion of the town or city?), the income and employment characteristics of the resident population, and the extent to which there is stability or

rapid turnover and vacancies. Government activities affecting value include the level of taxation and special assessments (value is impaired by high taxes and unpaid special assessments), public and private deed restrictions (which increase value when providing protection against the encroachment of nuisances or variable land uses), the quality of the local public schools, and the quality of planning for the provision of services and the protection of open spaces.

It should be noted that although appraisers may include descriptions of the above set of variables, the final estimated value they report is based on probable market activity, that is, the value of the house is its selling price at a given time, and the selling price is chiefly a function of the agreement reached between a given seller and a given buyer. Of course, if the transaction involves mortgage financing, then the appraisal report may well affect the amount of mortgage financing available-- the size of the loan and the conditions under which the loan is made -- which may, in turn, modify the sales price. In a sense, then, the appraiser both simply reflects the workings of the market (particularly when using the market data or comparable approach to valuation, or the multiple regression versions of this approach) and also directly influences the market insofar as his/her appraisal reports are used to make decisions concerning mortgage loans. The influence of the appraiser is probably a conservative one, that is, the appraisal report reflects past market behavior which, in the process of being reported and estimated for the current transaction, influences present financing decisions as well as perceptions of current market value. In sum, although the appraiser strongly claims to reflect only the message "spoken" by a reified "market", he/she is also affecting the current and future market by

reminding buyers, sellers and lenders of those factors involved in previous sales, which are therefore implicit in the "value" of the site or land in the cost approach as well as explicitly laid out in the market data approach. It is small wonder, therefore, that such factors which were "formerly" considered as affecting house price -- such as racial composition of the neighborhood -- still appear as significant in recent hedonic price models (Berry, 1976: Guy *et al.*, 1982; Miller, 1982; Daniels, 1975; King and Miewskowski, 1973; Schnare, 1976): despite any claims to the contrary, the role of the appraiser has not been entirely neutral. Similarly, appraisers may influence the extent to which hazards, such as location on a floodplain or susceptibility to surface fault rupture, are translated into the "value" of the site and therefore the probable house price. It is clear that flood plain location is important for the appraisal report, especially because it is now required by lenders in communities participating in the national floodplain insurance program. It is less clear that appraisers have seriously considered the influence of earthquake hazards on land values. Whether earthquake hazards are included in appraisal reports and in estimates of appraised values is an empirical question, one which will be considered at some length in the next chapter.

It is noteworthy that some appraisal organizations have taken a particular interest in ensuring that real estate appraisers explicitly recognize the susceptibility of property to natural hazards. In 1983, the executive vice-president of the American Society of Appraisers actively sought the inclusion of such hazards in professional standards to be shared by the several major appraisal groups. At the February 1983 meeting of North American Conference of Appraisal Organizations, a set of professional valuation guidelines for appraisal practitioners was discussed, and the suggestion was made that the appraiser should

incorporate "within a real property appraisal report the property's vulnerability to damage from such hazards as earthquake, flood, hurricane, as might be determined from available records and studies." (MacBride, 1983). Although this topic was presented, no formal action was taken. However, the interest of professional appraisal associations in including natural hazards routinely in real property appraisal reports signifies the possibility of further attention by appraisers to such factors, which would then likely be translated into greater seller/buyer/lender awareness of site-specific natural hazards.

Home Mortgage Lending Practices

Most real estate lending over the past twenty years has been in the hands of a few types of institutions. In 1975, almost half of all short-term (construction) and long-term mortgage loans for 1-4 family units were owed to savings and loans (45.6 percent), with commercial banks, mutual savings banks, and federally related agencies such as GNMA, FHLMC and Farmers Home Administration accounting for between 10 and 15 percent each. The combination of life insurance companies, real estate investment trusts, mortgage companies, state and local agencies, and pension funds accounted for less than 7 percent of the total. The reasons behind this specialization in lending are complex, but are largely based on government regulations concerning (1) tax-induced investment policy of savings and loans, and (2) the relative interest rates on demand deposits which commercial banks or savings and loans are permitted to pay, as well as market conditions concerning relatively high-yield and low-yield investments. In the mid-1970's then, home mortgage loan debt was largely held by savings and loans, commercial banks, and mutual savings banks, accounting for almost 75 percent of the total indebtedness.

What factors are involved in the underwriting decisions of these types of financial institutions? General portfolio decisions concerning the amount of money available for home loans are made first, involving regulatory constraints, liquidity needs, and the computation of the ratio of profit to risk in residential loans at a particular time. At a second level, decisions are made by loan officers or loan committees concerning particular applications for financing. Two factors are considered: characteristics of the borrower and characteristics of the security property.

Because experience has indicated that certain types of borrowers and security properties have greater degrees of risk of default or delinquency, lenders try to take into account those qualities which indicate a lower-risk mortgage loan (Houghland, Stone and Brueggiman, 1977). In evaluating the borrower, the lender considers both his/her present and likely future financial condition. In the loan application, therefore, the lender asks for information such as the current income of the borrower and co-signators to the loan, the size and composition of the household, other personal assets which might be liquidated to pay for loan payments such as automobiles, savings accounts, stocks or bonds, or life insurance, as well as information concerning the credit background of the individual, including previous loans and current indebtedness. In the evaluation of income, stability in the job as well as security of income related to the job are weighted. The repayment of past debts is a particularly significant factor since past delinquency in loan repayment is taken as an indicator of future performance. Equity in the property or the size of the downpayment is also related to the riskiness of the loan, since a higher loan-to-value ratio (a relatively lower downpayment) means greater risk on the part of the lender: the borrower is less likely to

default if he/she has a substantial positive net equity in the property (Weinrobe, 1983; Steindl, 1981). Personal characteristics are also assumed to be related to the probability of loan delinquency, since divorce, illness or other family problems seem to be related to delinquency, the risk-averse lender may interpret marital status and family stability as relating to the quality of a loan. However, lenders are prohibited by federal law from using sex or marital status in evaluating a loan, nor can they inquire into childbearing intentions of female applicants or co-borrowers. Because it is difficult to make a projection concerning future financial stability for each and every loan applicant, the lender often uses group projections as a basis for probability statements. These group projections are based on generalizations such as if the borrower has a relatively high income, he/she is less likely to default (Schafer and Ladd, 1981). If these group projections are inaccurate or out-of-date, or if an individual is not typical of the group, the use of such variables may discriminate against individual applicants.

The quality of the property being proposed as collateral is also very important. In the event of a foreclosure, the return on the loan will be affected by the value of the collateral, as well as the costs of foreclosure and the amount of the outstanding loan balance. The current market value of the property is an important factor in the projection of the quality of the collateral, but lenders must also consider future sales prices in order to discount risks involved in the loan.

Lenders may overlook questionable issues involved in borrower or collateral characteristics if the borrower takes on private mortgage insurance (insurance which protects the lender against losses associated with default and with premiums paid for by the borrower).

Such private mortgage insurance does not usually cover default related to earthquake damage, but such policies could be demanded. Similarly, the lender itself could obtain portfolio insurance at a fairly small cost. Such insurance would cut into the profitability of loans if costs were not passed on to the borrower in some form, but would also relieve the lender of any concerns related to losses not covered by the standard homeowner's policy.

Other factors may also enter into the final lending decision. For example, bankers vary with respect to whether they are risk-taking or risk-averse. Because some individual loan officers may see it to be advantageous to their careers to approve large numbers of loans rather than a smaller number of safer loans (Schweig, 1977), loans may be approved at some financial institutions that would be rejected at others. Obviously there is an interaction between the attitudes and career aspirations of loan officers and the evaluation of borrowers or collatoral property by lending institutions. Financial institutions vary in the extent to which such latitude in decision making by individual loan officers as opposed to a fairly uniform adherence to institutional criteria is tolerated.

Another factor in the lending decision is the desire of the lender to maintain good relationships with long-term and local customers. If customers have standing accounts with the financial institution, they may be able to receive better lending terms or may be trusted with loans which on objective criteria might otherwise be rejected. Although the relationship with the loan officer is more important for commercial than residential loans, it is likely also to be a factor in certain residential loan decisions.

Finally, the loan application is reviewed by a loan committee. The committee may assign a rating to the loan application based on

probability of default or risk. Conceptually, the decision of the loan committee can be cast in a Bayesian decision-making framework where judgments are periodically updated using posterior probabilities of financial distress and expected value maximization (Chalos, 1982 p. 24). The loan committee assigns a likely risk-payoff rating to each loan application, based on a combination of prior probabilities of default and competing alternatives for investment of limited financial resources.

The lending decision should not be conceptualized as a black-and-white process. Loan terms can be negotiated, and the willingness of the buyer to accept certain modifications may make the difference between the granting or refusal of a loan. Obviously, if the lender can receive a higher interest rate or higher origination fees (points) in a given transaction, or if the lender can reduce the loan-to-value ratio by requiring a higher downpayment as a condition for granting the loan, the loan decision will be more profitable in the first instance and more secure in the second. In addition, private mortgage insurance may increase the willingness of the lender to approve an otherwise risky loan. The premiums for such insurance are paid for by the borrower, and the policy insures the lending institution against defaults, which are normally declared when monthly mortgage payments are four months in arrears. Although such insurance makes the loan more costly to the borrower, it may be resorted to if the borrower wishes to increase the loan-to-value ratio over 80 percent of the appraised value. In short, several modifications can be made to the loan agreement making the terms even more favorable to the lending institution and further reducing its risk of losses resulting from defaults.

The previous chapters outlined the restrictive regulatory environment which constrains the behavior of home mortgage lenders. Although some decisions can be made purely on the basis of an economic calculation of probable profit and loss, other modifications in lender behavior must be attributed to government restrictions and interpretations of state and federal law, as well as individual variations and conflicting individual/corporate goals in the decision-making process. It is within this complex decision-making framework that we must view the response of residential real estate appraisers and home mortgage lenders. We should expect responses which reflect an attempt at profit-maximization, but within a regulatory environment which constricts the range of decision options and with some sharp institutional deviations which result from the effects of a variety of individual experience and personal, as opposed to corporate, motivations for advancement.

Natural Hazards in the Appraisal and Lending Decision-making Process

Although natural hazards are mentioned in the appraisal texts, and although the location of the property with respect to a floodplain is routinely reported in the appraisal report, it is not clear that such hazards have an independent impact on value. It is necessary that appraisers and lenders *believe* there is an association between natural hazards and market price, and *act* on this information. It is therefore important to ascertain empirically the perception and behavior of real estate appraisers with respect to the treatment of natural hazards in the appraisal and valuation process, as well as the interpretation of such reports by loan officers in granting or denying loans, or in modifying lending terms.

To study the differential treatment of classes of borrowers (e.g. racial discrimination in lending) or of classes or property (e.g. discrimination against high hazard areas in lending), one may set up an expected profit function against which lender behavior can be compared. In a similar analysis of differential treatment of borrowers, Shear and Yezer (1983) conceptualized this model as follows:

$$E(\Pi) = \delta(1 + r)L + (1 - \delta)\Theta V - (1 + i)L$$

where $E(\Pi)$ = expected profit;
δ = expected probability of the borrower not defaulting;
r = mortgage interest rate;
L = mortgage amount;
Θ = share of house value not captured by collection costs when default occurs;
V = expected value of house conditional on foreclosure occurring; and
i = opportunity of cost of capital

Verbally this model can be summarized as a calculation of expected profit from a mortgage loan as equal to revenue from the loan (based on interest rate and resale value in the event of a default) minus the cost of making the loan (based on non-investment in competing options). Mortgage interest rate should be higher if the loan officer's perception of the possibility of default risk is higher, or if opportunity costs are higher, or if collection costs when a default occurs are higher. For the lender following this type of "rational" model, it is significant to know whether the probability of default is believed to be affected by the location of a property in an area susceptible to a natural hazard. Again, this probability is an empirical question, although apart from evidence of past borrower performance, the lender's *perception* of this probability is as important as the actual default history.

Only a few studies have investigated the actual pattern of home mortgage defaulting following a major disaster. An example is the work

by Anderson and Weinrobe for the Federal Home Mortgage Corporation completed in 1980 (Kaplan-Smith, 1980). Anderson and Weinrobe studied the impacts on home mortgage delinquencies and defaults of four natural disasters and one economic recession: the 1974 Xenia, Ohio tornado; the 1977 Johnstown, Pennsylvania flood; the 1972 Wilkes-Barre, Pennsylvania flood; the 1971 San Fernando, California earthquake; and the 1968-74 "Boeing recession" in Seattle, Washington. Although the Seattle recession caused far more delinquency and foreclosures in home mortgages than any of the natural disasters, there was also a substantial number of foreclosures and deeds in lieu associated with the San Fernando earthquake. Among the reasons hypothesized by Anderson and Weinrobe for the more severe impact of the earthquake on home mortgage delinquencies as opposed to the flooding and tornadoes were "the condition of the local economy, the character of the individuals involved, the type of damage done in the earthquake as opposed to the type generally done in floods, [and] the absence of earthquake insurance."

This evidence suggests that the occurrence of a major earthquake may indeed increase the number of foreclosures and delinquencies above that normally experienced in a given community. Whether such an increase would actually seriously damage the financial picture of mortgage lenders is an empirical question that probably cannot be answered until a major damaging earthquake occurs. What is more immediately relevant is the expectation of executives of lending institutions concerning the probable outcomes of such a disaster. If it is true that executives believe the value of land is sufficiently high or that the equity position of most borrowers exceeds probable losses, then they would also believe that their investments would probably not be greatly affected by a major earthquake, and one would

expect little response to this factor in lending decisions. If, however, some lenders fear major potential financial losses associated with foreclosure proceedings, or, in a period of weak or declining house values, fear that negative net equities may indeed arise, then they may take measures to ensure the safety of their mortgage investments. Even if only a small number of home mortgage lenders refuse to grant conventional loans or require higher downpayments or earthquake insurance in areas particularly susceptible to seismic-related damage, the result will be a reduction in the flow of mortgage funds and a relatively higher cost of obtaining mortgage financing. In the context of the U.S. housing market which is highly dependent on mortgage financing, the incorporation of geologic hazards into the lending decision has a central role in affecting house prices in areas susceptible to such hazards.

CHAPTER IV THE INTEGRATION OF EARTHQUAKE HAZARDS INTO THE REAL ESTATE APPRAISAL PROCESS

In the previous chapter, we noted that real estate appraisers have an important role in not only "reflecting" the housing market, but in some ways directing attention to particular housing or neighborhood characteristics to be included in the valuation of property. The market data approach to valuation, most frequently used for single family residential property, may involve the use of hedonic price estimates which are supposed to estimate the market values for the various components which make up the final price of a given property. Among these components are site characteristics, including hazards--natural or human-made -- which may affect the value of the property. Standard texts advise appraisers to note flood, landslide and earthquake hazards among others. The empirical question is the extent to which appraisers do note these hazards, and the ways in which such notations may be translated into market price estimates.

In order to ascertain the current practices and attitudes of real estate appraisers, a survey of 30 California appraisers was conducted between November, 1982 and February, 1983. The questionnaire was pre-tested with face-to-face interviews, and the final interviews were conducted by telephone. Appraisers interviewed were drawn from a list compiled from the directories of the American Society of Appraisers, the Society of Real Estate Appraisers, and the American Institute of Real Estate Appraisers. In all but one of the cases, appraisers to be sampled were independent fee appraisers, that is, appraisers who were self-employed or employed by an appraisal firm rather than appraisers employed by real estate agencies or financial institutions on a full-time basis.

Appraisers were contacted by letter to explain the nature of the survey and notify them that an interviewer would be telephoning them to set up a time for the interview. At the mutually agreed upon interview time, the interviewer telephoned and administered a questionnaire (Appendix I) designed to elicit information about the appraisal process, and the extent to which various natural hazards are noted in the appraisal report and integrated into the market price etimate.

It had been hypothesized that experience in real estate appraisal in the local area and the type of clients for which appraisals were handled might affect the perceptions and procedure for integrating hazards information. For example, appraisers chiefly employed by lenders should routinely report on all those characteristics affecting the lending decision, a set which should differ from the characteristics owner-occupiers would consider. Earthquake hazard would be more salient, then, to clients with a longer-term and more direct association with the property.

The survey respondents had usually been appraisers in the local area for more than ten years, and most of them were primarily employed by home mortgage lenders (Table IV-1). We found in cross-tabulations of responses that experience and client-type were *not* related to other responses.

TABLE IV-1 CHARACTERISTICS OF APPRAISERS

Years of experience:

5-10 years	9
More than 10 years	21

Percentage of appraisals of single family homes and condo units for various clients (median percentage for each category)

Client type	Median percentage[1]
Lenders	50.0
Employee transfers	10.5
Dissolution (divorce)	4.9
Sellers	1.8
Buyers	1.5
Other	5.2

[1] Median percentages are used because of the large variation in each category and do not sum to 100%

The predominance of lenders among the clients of appraisers may reflect the fact that many sellers accept market appraisals from real estate agents and that buyers do not as a rule employ an independent appraiser. If these conjectures are generally valid, then the potential role of independent appraisers in providing environmental information to the homebuying public seems severely limited, particularly given the current general practice by lenders to require the buyer to pay for the appraisal report but not to share its contents.

Appraisers were asked to list the site characteristics they considered as most important influences on value when making a home appraisal. Only nine of the respondents (30%) mentioned any type of natural hazard such as flooding, landslides or seismic risk in response to this question. Further cross-tabulations of this response indicated that appraisers were most likely to mention hazards as affecting the sales price when they perceived some of their clients were concerned with hazards areas such as flood plains or special studies zones. This response indicates that most appraisers do not consider special studies zones, seismic risk areas, flood plain locations, or known landslide areas to be major determinants of house price, nor do most believe that their clients place particular emphasis on these factors in the valuation of property.

A set of questions asked appraisers about their impression of their *clients'* perceptions of the importance of various indications of hazardous site conditions: whether their clients would consider the characteristic as not important to the appraisal, somewhat important and should be noted, or very important and should be reflected in the appraised value. Appraisers were asked to assess the perceptions of lenders, buyers and sellers with respect to landslide-prone areas, flood plain locations, property located on a known earthquake fault trace, property located within a special studies zone, or a housing unit showing evidence of seismic or landslide damage. Appraisers reported a surprising uniformity in the importance placed on each of these hazards by lenders and buyers (Table IV-2). Evaluations are reported in two ways: a mean response and the percentage of appraisers who reported that their clients would evaluate the characteristic as "not important". Even for that class of clients least likely to be concerned with geologic hazards, the sellers of real property, the

majority were perceived to evaluate hazards as either somewhat important or very important. The characteristic viewed as least important to the appraisal was location in a special studies zone, considered to be "not important" by 39.3 percent of the sellers, 10.7 percent of the buyers, and 11.1 percent of the lenders. "Evidence of seismic or landslide damage," was viewed as "not important" by 27 percent of the sellers, but never viewed as "not important" by either buyers or lenders. Generally, lenders were perceived as more concerned with all of the hazards than buyers or sellers.

TABLE IV-2 APPRAISERS' PERCEPTIONS OF CLIENTS' ATTITUDES TOWARDS HAZARDS

	Client					
	Lender		Buyer		Seller	
	Mean score*	% Not Imp	Mean score	% Not Imp	Mean score	% Not Imp
Landslide prone-area	2.8	0.0	2.8	0.0	2.1	34.5
Flood plain	2.6	6.9	2.5	6.9	1.9	37.9
On an earthquake studies fault trace	2.5	7.4	2.5	7.1	1.9	35.7
In a special studies zone	2.5	11.1	2.4	10.7	1.9	39.3
Evidence of seismic or landslide damage	2.9	0	2.9	0	2.6	27.0

*mean score is the mean of the responses where 1.0 = not important and 3.0 = very important.

"% Not Imp" is the percentage of the respondents who indicated that factor would be rated as "not important"

Cross tabulations between appraisers' evaluations of client attitudes and their own propensity to mention natural hazards as influencing house values showed statistically significant relationships. Those who mentioned hazards as having an important effect on house values were more likely to perceive that lenders considered location in a flood plain and location in a special studies zone to be of greater importance. They were also more likely than other appraisers to recognize that sellers perceive location in a special studies zone as very important.

Appraisers were asked whether they had ever had a client ask for information concerning seismic hazard on a specific subject property. Thirteen of the respondents (43%) said this had never happened, 14 said it had seldom happened (47%), and only three (about 10%) said that they were frequently asked about seismic hazard by clients. Those who have had experience with clients asking for information concerning seismic hazard associated with a specific property were also more likely to have said that they routinely investigate whether a subject property is located on a surface fault trace or landslide-prone area, to note this in the appraisal report, and to check comparables for both characteristics. Appraisers in this category also indicated that they were more likely to check on the location of the subject property with respect to surface fault traces and landslide-prone areas even if the client did not request it.

A detailed set of questions probed the practices of real estate appraisers with respect to the incorporation of environmental factors. Appraisers were asked whether they routinely investigate whether a given factor applies to the subject property, note it in the appraisal report if it does apply, identify whether each of the comparable sales

is located in a similar area (to make certain that the factor is weighted in the analysis of comparables), and identify the impact of this environmental factor on the sales price. Finally, appraisers were asked whether they do such investigations even when the client does not request them. The five environmental factors listed for this question were location in a flood plain, location in a special studies zone, location directly on a surface fault trace, location in a landslide area, and damage to the dwelling unit from previous seismic activity (Table IV-3).

TABLE IV-3 INVESTIGATION OF ENVIRONMENTAL HAZARDS

How do you usually incorporate the following environmental factors in home appraisals:

	Flood plain	Special Studies Zone	On surface trace	Landslide area	Seismic damage
	(percent "yes" answers)				
Investigate whether this factor applies	93	67	37	57	63
Note in appraisal report	87	53	37	63	63
Identify comparable sales	77	57	23	43	27
Identify amount of price adjustment	23	17	13	33	17
Without client request?	87	60	47	73	67

Appraisers said they almost always investigated whether the subject property was in a flood plain (93%) whether or not the client requested such an investigation (87%). The high positive response to this question is not surprising in light of the Federal Flood Insurance Act, and the fact that lending institutions were the prime clients of most of the appraisers interviewed. The Federal Flood Insurance Act provisions require the lender to investigate whether a property is located in a flood plain and to note this fact on the loan report. The appraiser is called upon to investigate the flood plain status of the subject property. In fact, according to most appraisers in the survey, federal flood plain maps are a standard item of reference in the appraisal trade.

Two-thirds of the appraisers also indicated that they investigated whether the subject property was in a special studies zone or showed damage from previous seismic activity, again regardless of whether or not the client requested this investigation. More than half (57%) said they investigated whether the property was in a landslide-prone area. Most did not investigate whether the property was on a surface fault trace (only 37% do this investigation).

Although hazards may be investigated and their presence may be noted in the appraisal report, it is not likely that comparables will be checked for similar hazard conditions, and it is highly exceptional that any price adjustment for the existence of an environmental hazard is made. For example, only thirteen percent of the appraisers would identify a price adjustment for a property known to be located on a surface fault trace.

When asked about the information sources used to locate earthquake and other geologic hazards, appraisers usually cited maps

from the city and county, local planning departments, or California special studies zones maps. They also used the Thomas Brothers street atlas, which has recently published overlays of special studies zones and floodplain areas for Los Angeles, Orange, and San Francisco Counties. When asked whether they would use maps differentiating hazard potential at a block or individual property level if these were available, most (87 percent) said they would use them to check the subject property location and select comparable sales (73 percent).

To elicit an even clearer view of the way in which appraisers incorporate earthquake hazards into a property valuation, we provided the appraisers with an example of a typical property, and asked them to make an appropriate price adjustment. They were asked to estimate the 1982 price of a "fifteen-year old tract or semi-custom house with 1800 square feet, 3 bedrooms and 2 bathrooms on a standard-sized lot in an average middle-income and middle-aged neighborhood in this community." The median price estimated by the California appraisers for such a house was $160,000, with the estimated prices ranging from $115,000 to $250,000. They were then asked, "in your experience, what range of price reduction have you encountered if the property were in a mapped floodplain?" Most responded that were was no price reduction at all, with the median response being 0.3%. If the property were in a landslide-prone area, overall the appraisers estimated there would be about a 17% price reduction, although 25% of the appraisers still said there would be no price adjustment at all. If the area were in a fault rupture zone or special studies zone, most (75%) said there would be no price reduction, with a median response of 0.1% percent. If there was evidence of structural damage from previous earth movement such as cracked walls or foundations, there would be a 10% price reduction, although again a sizeable number (40%) said there would be no price

adjustment at all. In short, appraisers felt that location in a landslide-prone area or actual damage from previous earth movement would have a significant effect on price, but that the mere location of a property within a mapped floodplain area or special studies zone would not lower the house price. It should be noted that this peception by appraisers is in agreement with statistical analysis previously completed by the author (Palm, 1981), but is in conflict with that done by others (Brookshire and Schulze, 1980).

Finally, the appraisers were asked about the professional ethics involved in disclosing environmental hazards to clients. The question was phrased: "should appraisers routinely report whether a subject property is in a known hazardous area?" The appraisers were virtually unanimous in their positive response to this question, indicating support for the efforts of some of the appraisal societies to explicitly incorporate the reporting of hazards information in standard appraisal forms.

Conclusions

In answer to the question, "do appraisers supply earthquake hazards information to clients," one would have to respond, "yes, particularly when asked." However, appraisers feel that environmental hazards cannot and should not be isolated from the many other variables that determine the value of the property. Generally, in their informal comments, they indicated that they feel that earthquakes occur very infrequently, and that earthquake hazards in California are so widespread that they cannot be isolated as an influence on value. In addition, after an earthquake has occurred the effect on price is generally small and short-lived. Thus, while appraisers feel it is their professional responsibility to report the existence of environmental hazards to their clients, and seem quite knowledgeable as

to sources of information available to investigate their relevance for individual parcels, they are not convinced that environmental hazards have a significant effect on value. Since appraisers believe that they *reflect* but do not *affect* value, they use only those factors in their appraisal which they feel have been incorporated "by the market" to affect house price. Appraisers can and do provide notations concerning the location of a property with respect to a special studies zone or mapped surface fault trace, and express a willingness to use large-scale multi-hazard maps for their reporting procedures, but obviously do not incorporate this information in their estimate of market value.

CHAPTER V SURVEYS OF THE PRACTICES AND POLICIES OF HOME MORTGAGE LENDERS IN WASHINGTON AND CALIFORNIA

During the last three months of 1982, a sample survey was conducted in Washington and California. The survey was designed to provide empirical information on the response of lenders to environmental uncertainties. The general model of investment decision making is based on a portfolio analysis which is derived from the well-accepted expected utility model. This survey was intended to uncover information to extend this model to a case where there is a considerable amount of environmental uncertainty, as well as possible conflict between individual beliefs and the performance expected by the corporation/institution.

Questionnaires probed the extent to which lenders incorporate geologic hazards in their underwriting practices, whether lenders feel they can ascribe seismic hazards to individual parcels in setting loan terms, whether they make any additional stipulations when making loans in particularly hazardous areas, whether they protect their own buildings or commercial real estate with earthquake insurance, and what they believe will result after a major damaging earthquake.

Survey Design

The survey was stratified by state location, and within California by institutional size. Thirty interviews were conducted in Washington and 90 were scheduled for California. The Washington sample was composed of the 30 top home mortgage originators as of 1981, and included commercial banks, mutual savings banks, and savings and loans (Figure V-1). The California sample included the two types of lenders accounting for most residential mortgage originations in California: commercial banks and savings and loans (Figure V-2). Of the $139.7

FIGURE V-1

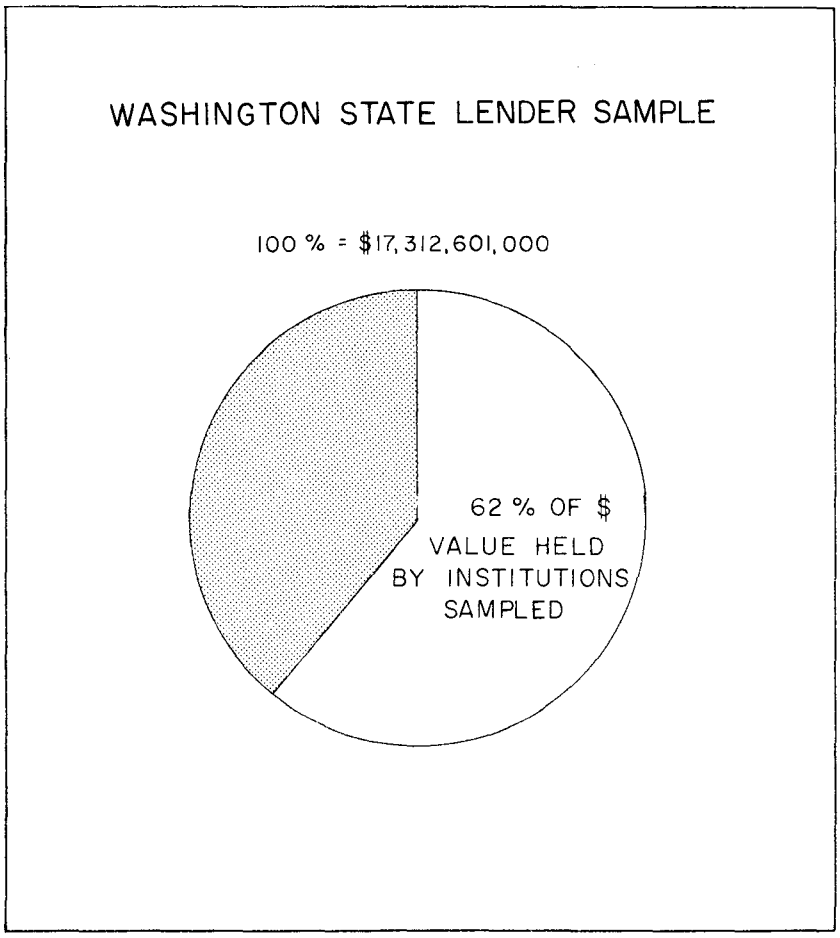
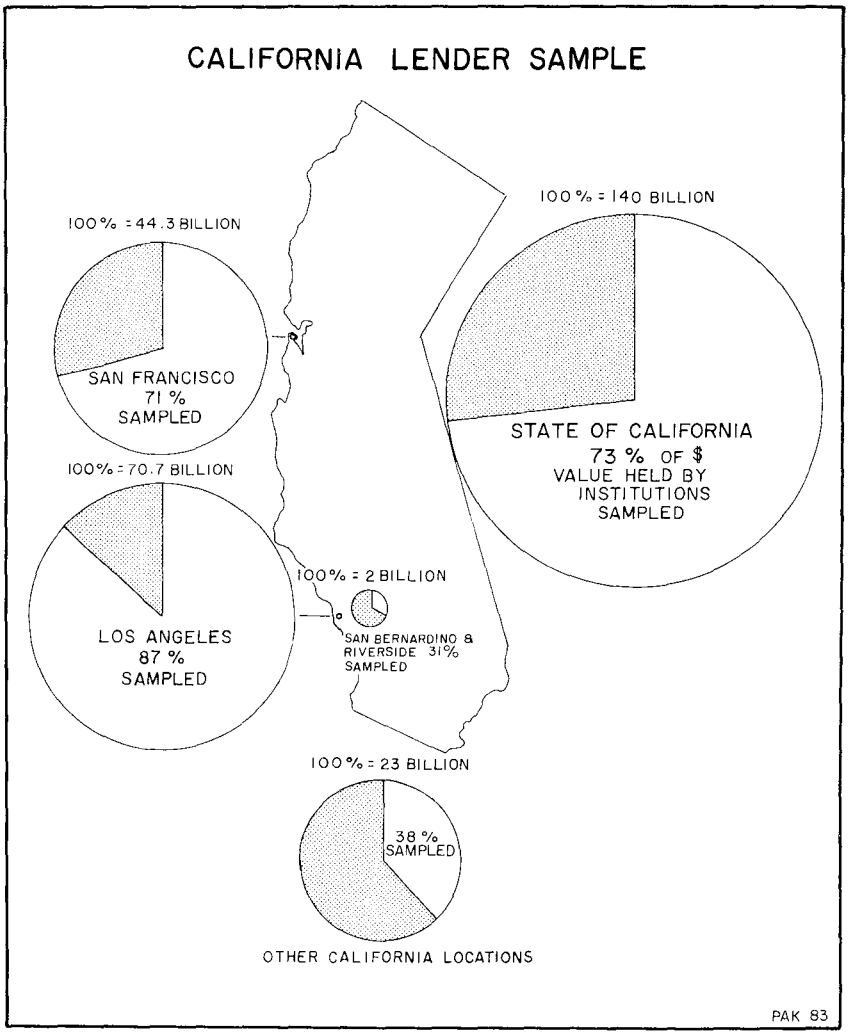

WASHINGTON STATE LENDER SAMPLE
100 % = $17,312,601,000
62 % OF $
VALUE HELD
BY INSTITUTIONS
SAMPLED

FIGURE V-2


CALIFORNIA LENDER SAMPLE
100% = 140 BILLION
100% = 44.3 BILLION
SAN FRANCISCO
71 %
SAMPLED
STATE OF CALIFORNIA
73 % OF $
VALUE HELD BY
INSTITUTIONS
SAMPLED
100% = 70.7 BILLION
100% = 2 BILLION
LOS ANGELES
87 %
SAMPLED
SAN BERNARDINO &
RIVERSIDE 31%
SAMPLED
100% = 23 BILLION
38 %
SAMPLED
OTHER CALIFORNIA LOCATIONS
PAK 83

billion dollars in residential loans in the portfolios of these institutions, the 186 savings and loans accounted for 111.4 billion, or almost 80 percent, with the other 20 percent (28.4 billion) from the 248 commercial banks. Of these 434 institutions, 144 were eliminated from the sample because they were not located in the three major California metropolitan areas (San Francisco region, Los Angeles-Orange County, and San Bernardino-Riverside) which contain a major part of the home loan activity as well as areas of intense seismic risk. Another 45 institutions were eliminated because they had no residential mortgages. Of the remaining lenders, we selected all of the top 30 home mortgage investors, whose individual residential loan portfolios contained from $420 million to $12 billion in loans outstanding (as of late 1981). Twenty-eight interviews were completed in this category. Thirty of the next largest lenders with individual assets ranging from $27 million to $400 million in residential loans were interviewed in the second sample. The last sample was that of small lenders with portfolios of no less than $750,000 in residential mortgages outstanding. Although it was intended that 30 executives from these institutions be interviewed, only 21 were available for interviews, often because such institutions had already merged or were in the process of merging with larger institutions, were newly formed institutions, or because they were doing very little home mortgage loan origination in 1982 because of relatively high interest rates and a sluggish real estate market.

Because there is a relationship between the size of the mortgage portfolio and the type of lending institution (that is, commercial bank vs. savings and loan), the smaller lenders tended to be commercial banks, while most of the larger lenders were likely to be savings and loans. The reason for this relationship is a combination of

regulations concerning the percentage of portfolios which federally chartered savings and loans must commit to local residential mortgage loans, as well as recent economic conditions which have discouraged lenders who are not otherwise required to make residential loans to avoid such investments. The resulting sampling frame was therefore complex, with a heavy emphasis on savings and loans and a far smaller portion of the sample including commercial banks. A summary of the characteristics of institutions within the two study areas is presented in Table V-1.

TABLE V-1 FINANCIAL INSTITUTIONS SAMPLED

	WASHINGTON	CALIFORNIA
Savings and Loans	22 (1.4 billion to $128 million)*	55 ($12.2 billion to $3 million)*
Commercial banks	5 ($944-$187 million)	23 ($11.5 billion to $750 million)
Mutual savings	3 ($1.9 billion to $198 million)	

*This number represents the size of the portfolio in home mortgages originated by lending institution.

Chief executive officers were contacted by letter (Appendix II), and asked to designate an officer who would be available to us for an interview. The initial letters to California chief executive officers were accompanied by letters of endorsement signed by the vice president of the Federal Reserve Bank in California in the case of commercial

banks, and by the vice president of the Federal Home Loan Bank of San Francisco for the savings and loans. The chief executive officer was then contacted by telephone to arrange an appointment with the individual he/she designated. In most cases. interviewees were the presidents themselves, or executive vice presidents in charge of residential lending. In some cases, more than one individual from the lending institution was present at the interview.

The questionnaire was pretested with fifteen sample interviews in Colorado, Washington, and California. The questionnaire was also modified after discussion with the advisory committee, state and federal banking officials, emergency service officials, state legislators, executives of several major lending institutions and regulatory boards, civil engineers, and consultants. The final version of the questionniare (Appendix III) was dramatically shortened after the pretesting, but still took a minimum of 45 minutes to administer.

The Lender Survey Results

Lenders were first asked to list the characteristics of a property which they consider to be important in the decision to grant a home mortgage loan. From the list of items mentioned, we tabulated those responses which included some sort of geophysical hazard. such as location in a floodplain, location with respect to a known earthquake fault, or susceptibility of the property to landslides. Overall, 63 percent of the lenders did not mention any geophysical hazard. This percentage response was roughly the same when cross-tabulated by banks or savings and loans, or by location in California or Washington, or by size of lending institution within California.

Next, lenders were asked to focus specifically on seismic risk. They were asked whether they considered seismic risks to their own real

assets, such as corporate headquarters. Overall, 83% of the lenders responded that they do not consider such risks, with no significant difference in this response between California or Washington, and between banks or savings and loans. There was a statistically significant relationship in this response by size of institution, however. Larger lenders were more likely to consider seismic risk to their own real assets than were smaller lenders; thirty-six percent of the top 30 lenders in California indicated they do consider seismic risk to real assets, while only five percent of the smaller lenders gave this response. Lenders also varied in their investment in insurance. Overall, only 17 percent of all respondents had earthquake insurance on their real assets, with no statistically significant difference between Washington and California in this figure. However, large lenders were far more likely to have insured their real assets - 40 percent of the top thirty lenders had insurance on their own real assets while only 9 percent of the smaller lenders had such insurance.

Lenders were asked whether they had an earthquake contingency plan, which might involve anything from planning for duplication of computer tapes in the event of a power-shortage resulting from an earthquake, to plans for evacuation of employees. Sixty-five percent of the respondents did not have such plans. However, the development of contingency plans was far more frequently observed in California, where 45 percent of the lenders did have contingency plans. The larger lenders were more likely to have contingency plans; 65 percent of the top 30, but only 33 percent of the smaller California lenders had contingency plans.

Overall, lenders were somewhat more likely to consider seismic risks to commercial property than to their own real assets. Thirty-two percent indicated that they do consider seismic risk to commercial

property, with no significant difference in the California vs. Washington responses to this question. Again there was a major contrast by size of institution with larger institutions far more likely to give a positive response (fifty-two percent) than smaller institutions (twenty percent) (Table V-2). Overall, 35 percent consider seismic risk to commercial property within the appraisal process, and 25 percent use such information as a basis for setting loan conditions, such as requiring earthquake insurance. There was no statistically significant variation in this response between states, lender types, or size of institution.

Table V-2

DO YOU CONSIDER SEISMIC RISK IN EVALUATING LOANS ON COMMERCIAL PROPERTY?

	No	Yes
Size of Institution		
Large lenders	48%	52%
Middle-sized lenders	76%	24%
Small lenders	80%	20%
Total	68%	32%

Chi Square: 6.69 Significance: .035

Residential real estate loans are also not usually evaluated with respect to seismic hazard. Only 27 of the respondents (24%) indicated that they do consider seismic risk when evaluating residential real estate loans; most of these respondents (23) were in the state of California (Table V-3). Size of lender was not a factor in differentiating lenders which do from those who do not consider seismic risk in residential loans. Only 18 lenders used seismic conditions as

a basis for setting loan conditions (21 percent). Again, this percentage was not statistically related to lender type or size of institution. Recasting this finding, while it is true that 21 percent is a small minority of lenders, it is significant that one out of five lenders *does* consider seismic risk in setting loan conditions; it is of interest to determine the characteristics which seem to account for lender awareness of seismic risk.

Table V-3

DO YOU CONSIDER SEISMIC RISK WHEN EVALUATING LOANS ON RESIDENTIAL PROPERTY?

	No	Yes
State		
California	76%	24%
Washington	90%	10%
Total	79%	21%

Chi Square: 1.06 Significance: .30

The next set of questions focussed on lending behavior. Lenders were asked whether they had ever refused to lend or modified loan conditions based on a series of geologic or structural conditions. In the Washington survey, this list included the fact that the property was in a landslide-prone area, the dwelling unit was structurally unsound, there was evidence of previous damage from seismic or other geologic activity, or there was an absence of structural reinforcements to the unit (Figure V-3). In California, where surface fault traces are mapped and published as "special studies zones," lenders were asked if lending behavior was affected by the fact that a property was underlain by a surface fault trace (Figure V-4).

Lenders were to answer this question with never, rarely, sometimes, or frequently. In Washington, most lenders had never or rarely made such loan modifications for property in landslide areas (74%), for evidence of damage from seismic or geologic activity (82 percent), or for lack of structural reinforcements (93 percent). In California, most had never or rarely made such loan modifications because of location in a landslide-prone area (76 percent), for property underlain by surface fault trace (87 percent), for evidence of damage from seismic or other geologic activity (82 percent), or for absence of structural reinforcements (90 percent). Thus, the overwhelming majority of lenders never or rarely refuse to grant loans or make seismic-related modifications in loan conditions even for such factors as visible damage from previous seismic activity or knowledge that the property is located astride a surface fault trace.

Viewed the other way, however, there were ten California lenders who sometimes or frequently refused loans or made loan modifications when property was known to be underlain by a fault trace, and 14 who frequently or sometimes refuse or modify loans if there is evidence of damage from seismic activity. Again, it is of interest to learn who these lenders are, and why they have come to modify the industry practice in responding to seismic risk.

Another approach to eliciting information on lender behavior was to list a set of characteristics, and ask the lenders whether they would be not willing to loan, very willing to loan or neutral about that characteristic in a lending decision (Table V-4). Washington lenders were asked to evaluate unreinforced brick construction, woodframe construction, location in a landslide-area, and evidence of damage from previous earth movement such as a cracked foundation. It should be noted that in the Puget Sound region, areas susceptible to

FIGURE V-3

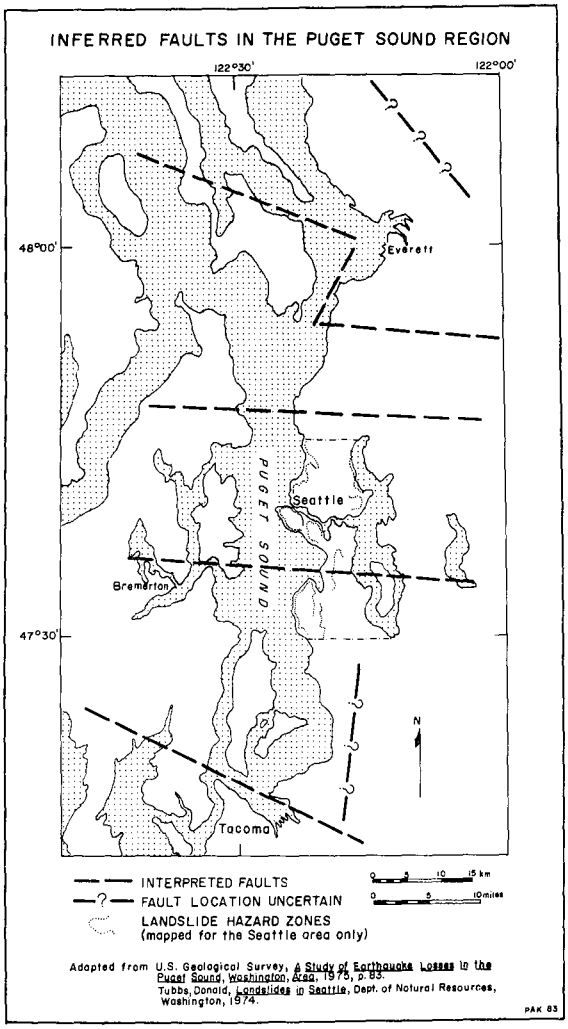
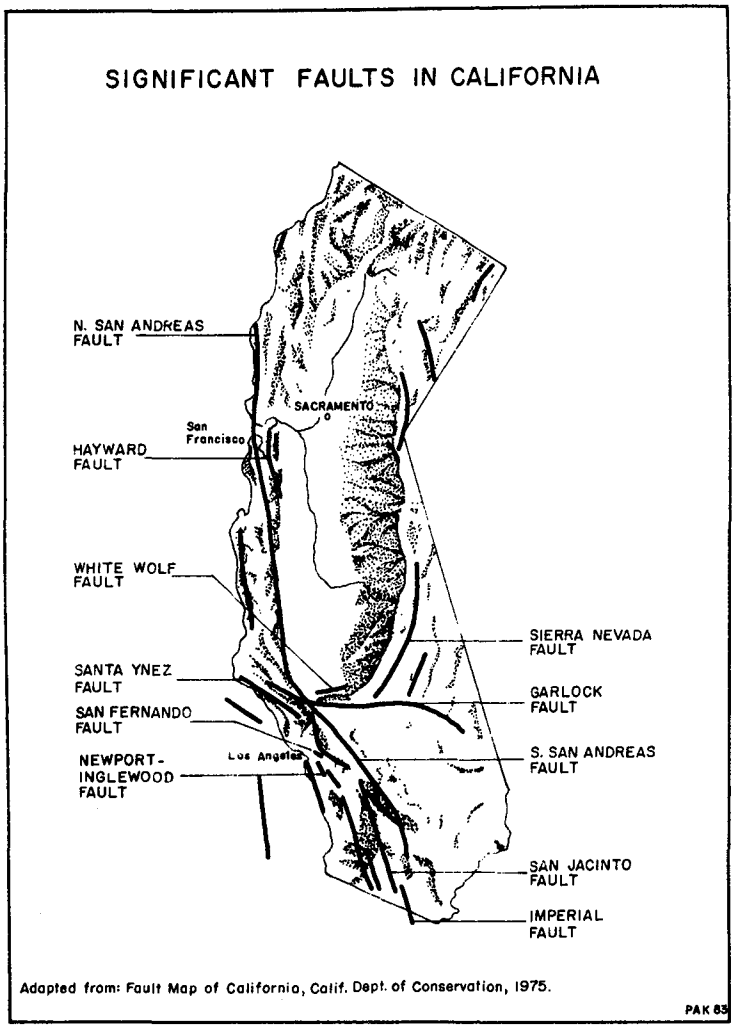

INFERRED FAULTS IN THE PUGET SOUND REGION
122°30'
122°00'
48°00'
47°30'
Everett
Seattle
Bremerton
Tacoma
PUGET SOUND
N
INTERPRETED FAULTS
FAULT LOCATION UNCERTAIN
LANDSLIDE HAZARD ZONES
(mapped for the Seattle area only)
0 5 10 15 km
0 5 10 miles
Adapted from U.S. Geological Survey, A Study of Earthquake Losses in the Puget Sound, Washington, Area, 1975, p. 83.
Tubbs, Donald, Landslides in Seattle, Dept. of Natural Resources, Washington, 1974.
PAK 83

FIGURE V-4


SIGNIFICANT FAULTS IN CALIFORNIA
N. SAN ANDREAS FAULT
SACRAMENTO
San Francisco
HAYWARD FAULT
WHITE WOLF FAULT
SIERRA NEVADA FAULT
SANTA YNEZ FAULT
GARLOCK FAULT
SAN FERNANDO FAULT
Los Angeles
NEWPORT-INGLEWOOD FAULT
S. SAN ANDREAS FAULT
SAN JACINTO FAULT
IMPERIAL FAULT
Adapted from: Fault Map of California, Calif. Dept. of Conservation, 1975.
PAK 83

mud-related landslide also appear to be especially susceptible to damage in earthquakes (Rasmussen *et al.*, 1974; Hopper *et al.*, 1975; Puget Sound Council of Governments, 1975). A score of "1" would indicate an unwillingness to loan under that condition, and a score of "5" would indicate a great willingness to loan. The mean response for unreinforced brick was 4.7, for woodframe was 4.9, for damage from previous earth movement was 2.9, and for landslide area was 2.2. The responses for lending on property damaged from previous earth movement were fairly evenly distributed, with the modal answer (3) indicating a relative indifference to this characteristic. Responses for lending in landslide-prone areas were more bi-modally distributed. The modal response was 1, and 73% of the lenders indicated an unwillingness to lend (response was 1 or 2) in such areas.

Table V-4

RATE THE IMPORTANCE OF EACH OF THESE CHARACTERISTICS IN APPROVING A LOAN.

(1 = not willing to loan; 5 = very willing to loan; 3 = neutral)

	Mean Response	
	California	Washington
Unreinforced brick	2.5	4.7
Woodframe construction	4.9	4.9
Landslide area	2.1	2.2
Seismic risk location such as a special studies zone	3.8	*
Evidence of damage from previous earthquake movement (e.g. cracked foundation)	3.0	2.9

* Not asked in Puget Sound interviews because of absence of appropriate micro-zonation maps or identification or fault rupture zones.

In California the characteristics rated were woodframe construction, unreinforced brick, landslide area, special studies zone, and evidence of damage from previous earth movement. Mean responses here were 4.9 for woodframe construction, 2.5 for unreinforced brick, 2.1 for landslide area, 3.8 for special studies zone, and 3.0 for evidence of previous earth movement. In California, there were greater reservations than in Washington about loans for unreinforced brick houses (55 percent of the respondents were not willing to make loans on such structures). Lenders in the two states had similar responses to woodframe dwellings, and a similar reluctance about loans in various landslide-prone areas, and on houses showing damage from previous earth movement.

The special studies zone response in California was highly varied. Although almost half of the lenders indicated a strong willingness to lend in such areas, 17 percent were very reluctant to grant loans in areas susceptible to seismic risk. This differentiation in response would indicate that at least some portion of the market is affected by lender attitude and behavior with respect to earthquake hazard, and the reasons for the strongly held minority opinion are important to probe.

One of the key issues in the problem of integrating earthquake hazards in the lending decision is the perceived relationship between earthquake hazard and probable mortgage default. If lenders believe that large numbers of households would default in the event of a major damaging earthquake, and that they could pinpoint areas that are particularly susceptible to earthquake-damage, then they *should* take steps to protect the security of their loans, and either avoid loans or modify lending conditions in these areas. The question, then, is what do lenders perceive to be major causes of mortgage default. Lenders

were asked to rank five possible causes of mortgage default including unemployment of the head of household, divorce, house fire, major flooding, and a major earthquake. In both California and Washington, lenders perceived a major earthquake as relatively unimportant as a cause of mortgage default (Table V-5).

Table V-5

RANKING OF POSSIBLE CAUSES OF MORTGAGE DEFAULT.

	Mean Rank	
	California	Washington
Unemployment	1.2	1.3
Divorce	2.2	1.7
House fire	3.7	3.7
Major flood	3.9	3.7
Earthquake	4.2	4.7

The assessment of earthquakes as a possible cause of default was probed in a question designed to elicit perceptions of the probable outcomes of a major damaging earthquake. The question provided a scenario developed by the USGS and FEMA for a probable local damaging earthquake (US Geological Survey, 1975; Federal Emergency Management Agency, 1981). In Washington the scenario read:

> When answering this question, please assume that we are talking about an earthquake with a postulated magnitude of 7.5, with its epicenter in Seattle and occurring at 2:00 p.m. According to a USGS study, the estimated deaths from such an earthquake would be 1,980 for the six- county Puget Sound Basin. There would be approximately 4 serious and 30 nonserious injuries for each death. The estimated damage to non- earthquake-resistant brick-masonry buildings in congested areas in the Puget Sound Basin would involve 30 percent of such buildings experiencing collapsed walls and 20 percent of these buildings collapsing.

In northern California, the scenario was derived from losses projected by the Federal Emergency Management Agency (FEMA) for an 8.3 Richter scale magnitude earthquake.

> An earthquake along the Northern San Andreas Fault has a moderate likelihood of occurrence. An 8.3 event would claim $38 billion in property damage, between 3,000 and 11,000 dead, and between 12,000 and 44,000 hospitalized, depending upon the time of day that the event occurs (1980 dollars).

In southern California, the lenders were read a similar scenario, but for the southern branch of the San Andreas fault. Figures were also based on Federal Emergency Management Agency projections:

> An earthquake along the Southern San Andreas fault has a high likelihood of occurrence. An 8.3 event would claim $17 billion in property damage, between 3,000 and 14,000 dead, and between 12,000 and 15,000 hospitalized, depending upon the time of day the event occurs (1980 dollars).

Lenders in the three regions were then asked to speculate on the likely outcomes of such an earthquake. (Table V-6).

Table V-6 LIKELY RESULTS OF A MAJOR EARTHQUAKE

	Percentage who said yes or maybe	
	California	Washington
local recession	71	57
state-wide recession	35	30
increased mortgage defaults	98	94
adequate government aid	41	43
changes in building code	75	87
insurers unable to meet liabilities	53	35
fire insurance more expensive	76	77
fire insurance unavailable	16	10
earthquake insurance unavailable	40	21

Although there are several interesting perceptions expressed in the answers of the lenders, three are particularly striking: first, that the combination of state and federal aid will not be adequate to reimburse homeowners for their disaster losses; second, that California lenders doubt whether earthquake insurers would be able to meet their existing liabilities; and third, that lenders are virtually unanimous in their expectation of an increase in mortgage defaulting. In other words, although lenders do not perceive earthquake hazards as being as important as divorce and unemployment in producing mortgage defaults, the lenders nonetheless expect some mortgage defaulting in the event of a major damaging earthquake. When asked to speculate on the percentage of their mortgage loan portfolio that would be in default after such an event, California and Washington lenders differed sharply (Table V-7). Washington lenders expect only a small percentage of their portfolio to be in default; eighty percent of the lenders expect less than 10 percent of their mortgages to be in default. Only 55% of California lenders expect such a low default ratio. Almost one-fourth of the California lenders expect more than 25% of their home mortgage portfolios to be in default. Since the probabilities for the kind of event described in the scenario are moderate to high for California, this expectation could result in precautionary measures taken by California lenders.

Table V-7

WHAT DEFAULT RATE MIGHT YOU EXPECT TO SEE IN YOUR MORTGAGE LOAN PORTFOLIO IN THE EVENT OF A MAJOR DAMAGING EARTHQUAKE?

	California	Washington
Percentage of defaults		
0 - 1	16 (23.5%)	12 (40.0%)
2 - 10	21 (31.3%)	12 (40.0%)
11 - 25	15 (22.4%)	5 (16.7%)
26 or more	15 (22.5%)	1 (3.3%)

Chi Square: 7.2 Significance: .065

The next section of the questionnaire asked lenders to evaluate the role of various actors in the housing transaction in preventing losses associated with earthquake hazards. Because of the relative acceptance of the federal flood insurance program as an external inducement to practice land use planning in flood hazard zones, and the universal adoption of mandatory fire insurance as a condition for home mortgage loans, some people have discussed the notion of earthquake insurance -- mandated privately by secondary or primary lending institutions, mandated publicly with some sort of mechanism for subsidizing costs, or generally adopted privately by home mortgage originators. To assess the response of lenders to earthquake insurance we asked: "do you feel that mortgage lenders could reduce potential economic losses by requiring earthquake insurance on properties in designated high seismic areas?" Almost 90 percent of the respondents indicated that mortgage lenders could reduce losses by such a requirement. When asked whether this idea was a practical one, there was more division of opinion. Overall, about half of the lenders felt

that mandated earthquake insurance was practical, but in California only about 45 percent responded affirmatively, while in Washington 71 percent said yes. This might be explained by the generally greater awareness of seismic hazard in California, as well as more experience with the feasibility of and the problems involved in earthquake insurance.

Since cost of earthquake insurance is often cited as a reason why people don't purchase it, we asked the lenders if the cost of earthquake insurance could be reduced from $2/1000 to $1/$1000, would they be more likely to require it on certain properties. Almost half of the lenders (44 percent) said that under these conditions they would be more likely to require earthquake insurance on certain properties. In Washington, this figure was only about 32 percent, but in California, 49 percent of the lenders not now requiring earthquake insurance indicated they would be more likely to require it if the cost were reduced. This finding may have implications for reduced-cost subsidized earthquake insurance, although it should be noted that merely saying they would require the insurance is a far step from actually instituting such a corporate policy.

Kunreuther (personal communcation, October 13, 1983) has suggested that there may be some reluctance on the part of financial institutions to enthusiastically endorse extensive earthquake coverage which may stem from the close association between lenders and the insurance industry. The insurance industry has opposed mandatory earthquake insurance, at least under the present system of cost accounting and with the present tax structures in place. They argue that there is generally not enough reinsurance capacity to withstand very large losses, and that tax laws do not permit them to accumulate sufficient reserves without severe financial penalty (Atkisson and

Petak, 1981). With this opposition from the insurance industry, it is unlikely that the financial community would promote a policy opposed by a close ally, a policy which would require major changes in regulation and economic organization to be feasible within a market system. However, our survey showed that lenders were generally favorably disposed to industry-wide mandatory earthquake insurance (70 percent said they would approve, or approve with qualifications), with little difference in this percentage between states or across institutions of different sizes. They were less in favor of mutual co-insurance to be created within the lending industry itself; overall, lenders were about equally divided in their opinions of this option, although more California lenders approved (56 percent) than Washington lenders (only 30 percent). Lenders were also approximately evenly divided over the possibility of a state-created insurance fund, with little variation by state or institution size. In general, the largest California lenders were somewhat more inclined to support some sort of industry-wide insurance scheme with 57 percent favoring a state insurance fund, 64 percent favoring mutual co-insurance, and 75 percent favoring mandatory earthquake insurance. These findings may have implications for the possibility of political support for industry-wide insurance from the major California lenders.

A final policy question concerned whether the lenders feel it is their professional responsibility to pass on information about earthquake hazards to homebuyers. Almost half of the lenders said it is their responsibility to inform buyers about earthquake hazards, another one-fourth said it is the responsibility of the real estate agent[1], and 18 percent said that the principle "buyer beware" should be

[1] California state legislation at present requires real estate agents to pass on a limited amount of information about earthquake hazards to homebuyers. The Alquist-Priolo Special Studies Zone Act as amended in 1975 requires real estate agents to inform prospective purchasers that a property is located within a delineated special studies zone. For the impacts of this legislation, see Palm, 1981.

operative. Other answers included the state government (10 percent), the builder (1.8 percent) or the insurance agent (1.8 percent). California lenders are less likely to take responsibility for informing buyers about earthquake hazards, however (Table V-8). Only 40 percent said it was the lender's responsibility, 28 percent said the real estate agent, 15 percent said let the buyer beware, and 11 percent said it was the state's responsibility. It is of interest that lenders did not mention appraisers as a source of information for buyers, another reflection of the current practice of buyers not to seek an independent appraisal and of lenders not to share with buyers the contents of the appraisal required by lenders but paid for by buyers.

Table V-8

WHOSE RESPONSIBILITY IS IT TO INFORM HOMEBUYERS OF EARTHQUAKE HAZARDS?

	(Percentage of Respondents)	
	California	Washington
Lender	40.5	51.6
Realtor	27.8	9.7
Let the buyer beware	15.2	25.8
State	11.4	6.5
Builder	2.5	0
Insurance Agent	2.5	0
Don't know	0	6.5

Another set of questions dealt with the role of the individual loan officer within the corporate setting. Studies in other areas (Hammond, 1980; Schweig, 1977) and background interviews with bank executives (Pozdena, 1982; Gibson, 1982) have indicated that the loan officer may separate his/her own personal beliefs and preferences from

the actual recommendations he/she makes to the loan board. The reasons for this separation of belief from action are complex, but include loan officer's perceptions of the kinds of behaviors necessary to achieve career advancement, and the length of time the loan officer may expect to be held "responsible" for a loan that eventually goes into default. The loan officer may understand that at a particular financial institution it is better to produce a larger profit by large numbers of loan recommendations, and in the process to approve loans which may involve a higher degree of risk. Or, the loan officer may be conservative in some loan recommendations, but may feel that since it is unlikely that an earthquake- related default will occur in the first three years of the loan period, the loan officer is "safe" in recommending such loans because it is likely that he/she will no longer be a loan officer in that period of time, or in any case will not be directly linked and therefore "responsible" for a given set of loans which eventually go into default following an earthquake.

Unfortunately a large-sample study with a 60-minute interview is insufficient to probe as sensitive and subtle an issue as the complex relationship between belief and action, and between individual and corporate advancement when these two are in conflict. However, to get some indication of variation in institutional attitudes towards volume vs. safety of lending decisions expected of loan officers, the lenders were asked: "to be a successful loan officer in your institution, would it be better to make more loans, even if some of them are risky, or to make fewer, more conservative lending decisions?" In general, the answers to this question fit the stereotype of fiduciary policy: 74 percent of the respondents said it would be better to make fewer and safer loans than to make more loans with higher attached risk. This percentage was similar for Washington and California, and for

California institutions of different sizes. It is significant, however, that 23 of the institutions indicated that the loan officer who made more loans, even if there was a greater risk attached, would achieve more personal-professional success in the lending institution. This difference indicates that there is a variability in institutional "ethos" which would be interesting to probe in greater depth in another study.

We also asked if a loan officer recommends that a loan should not be made because of seismic risk, whether this recommendation could be overridden. In most cases the answer was clearly yes (94 percent), but only seven of the respondents could ever remember such a case actually occurring. It is probably unusual that a loan officer would use seismic risk as a reason for not recommending a loan, that this decision would be appealed to a higher level, and that the loan officer's recommendation would be over-ruled. Therefore, although there may be conflicts between decision-making levels in loan recommendations, the seismic issue does not play a large part in such conflicts.

Finally, a set of questions on the lender's experience with earthquake hazards were posed. Lenders were asked if they had ever attended a seminar or presentation on earthquake hazards. None of the Washington respondents had attended such a seminar but 31 (40 percent) of the California respondents had already had such an experience. Most followed that question with an expression of interest in attending such a seminar (80 percent). Lenders at larger California institutions were more likely to have attended an earthquake risk seminar than those at smaller institutions; 60 percent of the top-30 lenders, but only 20 percent of the smaller institutions had attended an earthquake risk seminar. When asked whether the lender would consider seismic hazard

in his/her own personal decision to buy a house, the majority in California said *yes* (54 percent) while the majority in Washington said *no* (81 percent). California lenders in larger institutions were somewhat more likely to say they would consider earthquake hazard in their own home purchase. Most of the lenders interviewed do not now have earthquake insurance on their own homes (85% overall), with almost no Washington lenders carrying earthquake insurance.

Co-variation of Responses

Some of the individual questions and answers were particularly interesting, since they showed considerable variation in the response of mortgage lenders to earthquake hazards. A set of cross-tabulations of responses was therefore performed to examine some of the more complex interactions.

Variables included in this section of the analysis were: whether the lender considers seismic risk on loans for residential real estate, whether lenders are willing or reluctant to make home mortgage loans in special studies zones or other identified seismic risk areas, the number of years the respondent had been a loan officer, whether the respondent had insurance on his own home, and whether the lender would find a large-scale multi-hazard map useful in making lending decisions. A few of the salient relationships will be presented here.

California lenders who considered seismic risk in residential loans were also more likely to consider seismic risk to commercial property, were more likely to require earthquake insurance when there is evidence of previous seismic or geologic activity on a given dwelling unit, were more likely to favor lender-required earthquake insurance as a practical industry-wide policy, were more favorable to instituting earthquake insurance requirements if the cost of earthquake

insurance could be reduced, were more likely to require earthquake insurance for property located within a special studies zone, were more likely to refuse loans because of location within a special studies zone or a landslide-prone area, or because of evidence of previous damage to the dwelling unit from seismic or geologic activity, were more likely to state that it was the lender's responsibility to inform homebuyers about earthquake hazards, and were more likely to use geologic or other scientific information in their lending decisions. Two other correlates had particularly interesting policy implications. First, lenders who consider seismic conditions in residential real estate loans are *less likely* than other lenders to expect government aid to be adequate to reimburse homeowners for their disaster loans following a major earthquake. This implies that they are less likely to feel secure depending on outside aid, and therefore seem to feel that more effort should be made to avoid conditions which would expose homebuyers to losses which could be mitigated by taking seismic conditions into account. Second, lenders who consider seismic risk in residential loans are more likely to have attended a seminar on earthquake risk than those who do not consider seismic risk. This may be interpreted in two ways: either those individuals and institutions who are represented at such earthquake hazard seminars are already more likely to be concerned about earthquake hazards in their lending policies, or, alternatively, the earthquake hazard awareness seminars may be making lenders more aware of the implications of major damaging earthquakes. The latter interpretation would mean that further seminars sponsored by professional banking associations, regulatory agencies, or seismic safety groups *could* result in a change in attitudes and perhaps influence practices of home mortgage lenders.

A second question, asked in the California portion of the study, was whether lenders were willing or reluctant to make residential loans in "seismic risk locations, such as special studies zones." This question was re-tabulated on a three-point scale from "not willing to loan", neutral, or "very willing to loan." Reluctance to lend within a special studies zone or other such area was associated with the consideration of seismic risk to commercial and residential property, the requirement of earthquake insurance in special studies zones, the ranking of earthquake as a significant potential cause of mortgage default, the refusal of loans based on evidence of past seismic or geologic activity, the use of geologic or other scientific information in the lending decision, an interest in obtaining and using large-scale hazard maps, and a personal attitude that the respondent would consider earthquake hazards in any new home purchase. In short, a reluctance to make loans in seismic risk locations was associated with a favorable attitude to earthquake insurance requirements, a willingness to use large-scale hazard maps in lending decisions, and a personal risk-averse behavior in home-selection decisions.

Experience as a lending officer was related to only a few of the other variables. In California, those lenders who had been in their positions longer were less likely to consider seismic risk in commercial lending decisions, and in Washington, were less likely to favor large numbers of relatively high-risk loans. Generally, however, experience as a loan officer was not statistically related to hazard awareness.

California lenders who said they had earthquake insurance on their own homes: were less likely to expect a local recession as a result of a major earthquake, expect less default resulting from a major earthquake, and are less favorably inclined toward a state

insurance fund for all lenders. Few lenders in Washington had earthquake insurance on their homes, and this variable was not statistically related to other questionnaire variables for Washington.

Finally, lenders were asked "if there were maps available that could differentiate hazards potential at a block or individual property level, would you use such information?" Responses could range from "never" to "frequently." California lenders who said they would "frequently" use such a map were also more likely to require insurance for properties within seismic hazard or special studies zones, were less willing to lend in such areas, and answered that they would be interested in attending a seminar or presentation on earthquake hazards. In other words, large-scale maps would likely be first used by lenders already concerned with earthquake hazards in setting loan conditions.

Classification of Responses

The survey data were analyzed in order to discern patterns in relationships between those who consider earthquake hazards in lending decisions and those who do not. The variable set used to distinguish lending behavior included: size of institution, location in San Francisco or Los Angeles or Seattle-Tacoma, whether the lender was a commercial bank or a savings and loan, whether the lender believed it was likely that in the event of a major damaging earthquake insurers would not be able to meet their existing liabilities, the ranking of a major earthquake as a cause of mortgage default, whether the successful loan officer makes more but risky loans, or fewer but safe loans, whether the loan officer had attended a seminar on earthquake hazards, whether the lender would consider earthquake hazards in purchasing his own new home, whether the lender carried earthquake insurance on his own home, how long the respondent had been a loan officer, what

percent of the institutions' portfolio the respondent expected would be in default in the event of a major damaging earthquake, and whether the respondent felt it was the lender's responsibility to inform homebuyers of earthquake hazards. Discriminant functions were calculated on a set of variables including: willingness to make home mortgage loans in a special studies zone or other seismic risk zone (for California lenders), whether the lender considers seismic risk on residential real estate loans, whether the lender refuses loans or modifies loan conditions where there is evidence of seismic-related damage or in landslide prone areas, whether the lender requires earthquake insurance on loans in seismic risk areas or special studies zones, and whether the respondent mentioned geologic hazards as one of the characteristics of the property considered important in the decision to grant a home mortgage loan. The standardized canonical discriminant function coefficients were calculated from a stepwise procedure using a Wilks' lambda criterion (Rao, 1973).

The rating of seismic risk locations such as special studies zones in the approval of a home mortgage loan was related to two variables: the ranking of earthquake as a probable cause of mortgage defaulting, and the assessment of whose responsibility it is to inform homebuyers of earthquake hazards. Lenders more likely to take seismic hazard into account in loan approval also believed it was their responsibility to inform homebuyers of earthquake hazards, and tended to rank earthquakes relatively higher as a potential cause for mortgage defaulting. (Table V-9).

Table V-9 VARIABLE PATTERNS: SEISMIC RISK AND LOAN APPROVAL

Dependent variable: How would you rate seismic risk location such as special studies zone in approving a loan? Answers: not willing to loan or very willing to loan. (neutral answers eliminated)

	Standardized canonical discriminant function coefficients:	Significance of Wilks' lambda
Rank EQ as cause of default	-.662	.11
Lender's responsibility to inform homebuyers	.734	.11

Percentage of grouped cases correctly classified: 66.7

Lenders who said they considered seismic risk when making loans for residential real estate tended to feel it was the lender's responsibility to inform homebuyers of earthquake hazards, would consider seismic hazard in their own home purchase, presently had earthquake insurance on their own homes, placed a higher weighting on earthquake hazards as a cause for default, had attended a seminar on earthquake hazards, tended to come from banks rather than savings and loans, and had fewer years in their position (Table V-10). This function was particularly capable of distinguishing those who did consider seismic risk from those who did not, with 84 percent correctly classified by the function.

Table V-10 VARIABLE PATTERNS: SEISMIC RISK AND RESIDENTIAL LOANS

Dependent variable: Do you consider seismic risk when making loans for residential real estate?

	Standardized canonical discriminant function coefficients:	Significance of Wilks' lambda
Lenders responsibility to inform homebuyers	.55	.00
Would you consider seismic hazard if now buying own house?	.51	.00
Do you have earthquake insurance on own house	.40	.00
Have you attended EQ seminar?	.31	.00
Years as loan officer	-.29	.00
Bank vs. savings and loan (hi=bank)	.55	.00
Percentage of loans that would default	-.21	.00

Percentage of grouped cases correctly classified: 83.9

Lenders who actually refused loans because of seismic or geologic activity were likely to have earthquake insurance on their own house, to believe that it is better for a loan officer's career to make fewer, safe loans than more but riskier loans, to have attended an earthquake seminar, to believe that is it the lender's responsiblity to inform homebuyers of seismic risk, and to expect a higher percentage of default in the event of a major damaging earthquake. This classification function correctly accounted for about 74 percent of the observations (Table V-11).

Table V-11 VARIABLE PATTERNS: LOAN REFUSALS OR MODIFICATIONS FOR PREVIOUS DAMAGE

Have you ever refused to lend or modified loan conditions on evidence or previous damage from seismic or other geologic activity?

Standardized canonical discriminant function coefficients:

	Standardized canonical discriminant function coefficients:	Significance of Wilks' lambda
Do you have earthquake insurance on own house	.839	.00
Better to make fewer, safer loans	.462	.00
Have you attended EQ seminar?	.369	.00
Lenders responsiblity to inform homebuyers	.269	.00
Percentage of loans that would default	-.247	.00

Refusals to lend in landslide-prone areas were related to attendance at earthquake seminars, a relatively higher ranking of earthquake as a cause of default, the purchase of earthquake insurance for the lender's own house, a belief that a higher percentage of loans would be in default in the event of an earthquake, location outside of Los Angeles, and bank rather than savings and loan status. This discriminant function was also able to correctly classify about three-fourths of the cases (Table V-12).

Table V-12 VARIABLE PATTERNS: LOAN REFUSALS OR MODIFICATIONS IN LANDSIDE AREAS

Have you ever refused to lend or have you ever modified loan conditions based on the fact that the property is in a landslide prone area?

	Standardized canonical discriminant function coefficients:	Significance of Wilks' lambda
Have you attended EQ seminar	.538	.00
Ranking of earthquake as cause of default	.519	.00
Percentage of loans that would default	-.409	.00
Los Angeles	-.364	.00
Commercial bank vs. savings and loan	.330	.00
Do you have earthquake insurance on own house?	.642	.00

Lenders who mentioned geologic hazards in the open-ended question at the beginning of the interview tended to be located outside of Los Angeles, were from commercial banks rather than savings and loans, believed that insurers would not be able to meet their liabilities in the event of a major damging earthquake, had earthquake insurance on their own homes, and would consider seismic hazards if purchasing a home now (Table V-13).

Table V-13 VARIABLE PATTERNS: MENTION GEOLOGIC HAZARDS

Dependent variable: Respondent mentioned geologic hazards as one of the characteristics of the property considered to be important in the decision to grant a home mortgage loan

	Standardized canonical discriminant function coefficients:	Significance of Wilks' lambda
Location in Los Angeles	-.70	.06
Would you consider seismic hazard if now buying own house?	.65	.02
Insurers could not meet liabilities	-.48	.00
Do you have earthquake insurance on own house	.47	.00
Bank vs. savings and loan (hi = bank)	.41	.00

Percentage of grouped cases correctly classified: 66.7

The best fitting discriminant function in this series correctly classified almost ninety percent of the responses. This function fit the distinction between those institutions which do or do not require earthquake insurance for loans on property underlain by a surface fault trace (Table V-14). Fifty California lenders do not require such insurance, while 12 lenders do require insurance. Lending officers in institutions requiring earthquake insurance in such a case are likely to consider seismic hazard on their own property in purchasing a house, believe that a high percentage of loans would be in default in the event of a major earthquake, rank earthquakes has a relatively major cause of default, believe it is the lender's responsibility to inform homebuyers about earthquake hazards, come from larger lending

institutions, tend to be located in the San Francisco Bay area, believe it is better to make fewer but safer loans rather than large numbers of more risky loans to succeed as a loan officer, and have attended an earthquake seminar. The direction of all of these relationships is intuitively "correct," and the strength of this discriminant function indicates that there is a clear pattern among the respondents.

Table V-14 VARIABLE PATTERNS: EARTHQUAKE INSURANCE

Dependent variable: Do you require earthquake insurance for loans on property underlain by a surface fault trace?

	Standardized canonical discriminant function coefficients:	Significance of Wilks' lambda
Would you consider seismic hazard if now buying own house?	.58	.00
Percentage of loans that would default	-.64	.00
Rank EQ as cause of default	-.51	.00
Lender's responsibility to inform homebuyers	.53	.00
Size of lending institution	-.25	.00
Location of lender in San Francisco	.36	.00
Volume vs. safety as success criteria	.36	.00
Have you attende EQ seminar?	.22	.00
Lender's responsiblity to inform homebuyers	.53	.00

Percentage of grouped cases correctly classified: 88.6

Summary

The survey of Washington and California lenders reveals great variety in the perception of and response to earthquake hazards among home mortgage lenders. Although it is true that the majority of loan officers do not incorporate earthquake hazards into their lending policies, a sizeable minority of the largest lenders, particularly in California, report that they not only note seismic hazard in the lending decision, but that they also actively seek information on seismic hazard, using it to determine such loan conditions as earthquake insurance. In the absence of large-scale multi-hazard maps complete with probability statements concerning the likelihood of recurrence, lenders cannot and do not assign seismic hazards to indidivual parcels in setting loan conditions. However some of the lenders take the special studies zone designation in California very seriously, and state that they are reluctant to make loans without special hazards insurance on properties located in these areas. It should be noted that recent state court decisions may make the issue of separate earthquake insurance moot if decisions that homeowners policies must be extended to pay for earthquake damage when other contributing factors exist are upheld (Hertzberg, 1983). However, since this ruling came after the interviews were completed, the uncertainty surrounding earthquake insurance should not have affected the lender's responses.

Some large lenders, particularly in California, do make special requirements of homebuyers when making loans in particularly hazardous areas, protect their commercial investments and their own real assets with earthquake insurance, and tend to avoid loans or modify loan conditions on property susceptible to landslide or seismic damage. Attendence at earthquake hazards seminars is related to hazard

avoidance, although the causal path here is not clear. Finally, personal hazard avoidance -- as indicated by the purchase of earthquake insurance or avoidance of seismically hazardous areas by the loan officer in his or her own personal house selection -- seems to be related to institutional policy with respect to the consideration of seismic risk on residential real estate loans or earthquake insurance requirements. Thus, while it is generally true that lenders in both Washington and California tend to discount the effects of earthquake hazards on the stability and security of their loan portfolios, a sizeable minority of the larger California lenders do take earthquake hazards seriously and are taking mitigation measures to ensure their own financial positions. Any such response indicates a marginal market response which should be reflected in objective measures of house prices or mortgage availability. In the next chapter, a very rough estimate of the effect of special studies zone locations on the lending decisions is outlined.

Chapter VI THE DECISION TO ACCEPT OR REJECT A LOAN APPLICATION

The general model describing the decision to approve or reject a loan application involves an assessment of the risk of default. We have seen that most lenders in Washington or California do not consider seismic risks as a major cause of loan defaults, and that most do not hesitate to approve a loan on a property within a special studies zone or even directly on a known active surface fault trace. If even a small minority do not approve such loans, however, an empirical analysis of actual lending decisions should reflect this behavior. This portion of the study was designed to address the empirical question of the integration of seismic risk into lending decisions.

From 1976 to 1981, state-licensed savings and loan associations in California were required to keep detailed information on home loan applications. These data were reported through the Loan Register Report, available from the California Department of Savings and Loan. Data included in the report were the code for the lending institution, the county and census tract of the security property, the type of loan sought (e.g., construction, refinance, purchase), the lending decision, the loan amount, the appraised value (only for loans actually made), the sales price, the interest rate, the loan fee, the term of the loan, whether the interest rate was variable or fixed, the amount of loan requested, whether neighborhood factors were considered, the year the dwelling was built, the square footage of living area, whether the subject property was to be owner-occupied, total family income, ethnicity of the applicant, sex of the applicant, age of the applicant, monthly income of the applicant, and ethnicity, sex, age, and income of the co-applicant.

Added to the data set obtained from the Department of Savings and Loan was information on the seismic characteristics of the census tract. Micro-zonation has not been completed for the entire state of California, and even where this is complete, it is obvious that such zonation has not been widely available for use by the real estate and financial industry. Therefore, the more widely publicized special studies zones, currently available as overlays on Thomas Brothers street atlases and also widely available as a result of the Alquist-Priolo disclosure legislation, were used to approximate areas of seismic risk. A census tract was classified as either inside or outside the special studies zone. Large tracts which were only partially within a special studies zone were classified as either within or outside the zone on the basis of where most of the population was settled with respect to the zone location (Palm and Grow, 1981).

The data set contains several problems that should be noted at the outset. First, if the loan application was denied, then information was not necessarily provided on the appraised value of the subject property, limiting the usefulness of this characteristic in the analysis. Second, no information was available on would-be loan applicants who were discouraged from applying for a loan by the real estate agent or lending officer before the loan application was made. This may greatly distort the findings, since a systematic bias could have been introduced in the process of screening loan applicants. In addition, there was no information available on the stability of the borrower's income, the borrower's net wealth, or the borrower's credit history, all of which are important factors in the lender's decision equation.

Following the procedure used by Schafer and Ladd (1981) in their analysis of the same data set for race or sex-based discrimination, the

income variable was specified as a ratio of sales price to total borrower income minus 2.5. The subtraction of 2.5 from the ratio is done to reflect the "rule of thumb" used by lenders at this time that the sales price of a house should "usually" not exceed 250 percent of the borrower's annual income. Of course this rule has frequently been modified or ignored, particularly during the unstable period of high interest rates in the early 1980's, but was probably in effect during the study period.

The time period sampled was the spring and summer of 1979 and 1980, the second and third quarters of each of these years. The reason for selecting this period was to attempt to maximize the number of sales within a limited period of time (since most houses are sold in the spring and summer), and to draw the sample from the period preceding the leap in interest rates which began later in 1980. Of the total number of possible cases reported during this period (221,386), about 100,000 were processed (Table VI-1). The others were eliminated because they had occured in counties without census tracts (outside of Standard Metropolitan Statistical Areas), involved loans other than for the purchase of property (including refinance, construction loans, subordinate loans or residential improvement loans), or were for something other than single family dwellings (two or more units, commercial property, vacant land, or condominiums). In other words the only transactions considered were those within metropolitan areas with census tract information present, for single family homes, with first mortgages.

Table VI-1 The California Sample: Loan Refusals

Quarter	Total Cases	Processed	In Special Studies Zone	Not in Special Studies Zone
2nd 1979	80,649	37,398	3,660	33,738
3rd 1979	71,426	33,482	3,273	30,209
2nd 1980	21,470	9,609	1,079	8,530
3rd 1980	47,841	20,143	1,960	18,183
Total	221,386	100,632	9,972	90,660

The model examined was a fairly simple one, involving fewer variables than that calculated by Schafer and Ladd (1981). The decision to accept or reject a loan application was hypothesized to be some function of the ratio of sales price to borrower income, the age of the dwelling unit, whether it was to be owner- or renter- occupied, the ethnicity of the borrower, and whether the property was located in a special studies zone tract.

6.1 Decision = SP/TI - Age + Owner occup - Ethnicity - Special Studies Zone

Variables which also *should* be included in such a model were supplemental variables describing the borrower's credit history, more detailed assessment of the subject property, and information on the neighborhood immediately surrounding the subject property which might have an effect on its future values such as abandoned housing or poor upkeep in neighboring properties. Because this information was simply

not available, the model uses age of housing and proposed tenure status of the borrower as a general indicator of neighborhood quality, and race or ethnicity of the borrower to control for possible discrimination factors, weakly found to be present by Schafer and Ladd (1981) and Goebel (1982) as in their analysis of the same data set.

Data analysis was conducted for the state as a whole as well as for smaller housing submarkets. The state calculations were performed only to get a very general outline of the characteristics of lending decisions throughout the state in one glance. The calculations for the submarket approximations give a more detailed and more accurate picture of the actual contributions of individual variables to the lending decision, since it can be argued that various submarkets operate independently and with very different criteria (Straszheim, 1974). An example of this is the notion of age of housing which may be considered to have a negative impact on the lending decision in many areas, but would have a neutral or even positive impact in submarkets in which historic preservation of renovation were the norm, such as the city of San Francisco. It is generally true that neither SMSA nor income/ racial boundaries outline the submarket defined by information exchange. This information-bounded submarket is better estimated using Board of Realtors territories (Palm, 1978; Bourne, 1976). Counties within SMSAs were used to approximate Board of Realtors districts, although even those probably over- bound information fields (Palm, 1976).

For the state as a whole, 88,425 of the loan applications considered during the study period were accepted and 9,911 were denied. This means that almost ninety percent of the loan applications were acted upon favorably, casting some doubt on the proposition that loan applications were not already thoroughly screened before the

applications were completed. This screening may well have eliminated loans which were suspect, and may explain the fact that the pattern of rejected loans is not clearly explained by the expected risk factors. Loans on owner-occupied property were more likely to be approved (90.2 percent) than those for property to be occupied by other than the owner (86.3 percent of these applications were approved). Acceptance rates were also higher for Whites (90.9 percent) and Asians (90.2 percent) than for Hispanics (88.7 percent) or Blacks (80.3 percent). Loans to men were more likely to be granted (90.1 percent) than to women (88.3 percent). There was no statistically significant difference in the percentage of loan applications accepted for properties within the special studies zone (90.1 percent) as opposed to properties outside the special studies zone (89.9 percent).

The state and a sample of ten counties within the major SMSA's were analyzed systematically to test the appropriateness of the decision model posed as equation 6.1. The relationship of sales price/income, age of housing, owner-occupation, race or ethnicity of the borrower, and location of the tract in a special studies zone, to the lending decision were probed with t-tests on individual variables and the calculation of a discriminant function.

For a sample of 100,633 from the state as a whole, all of the hypothesized variables except special studies zone entered into a discriminant function which was able to correctly classify about two-thirds of the cases. Only four of the individual variables had "t" ratios which were statistically significant: Black borrowers, owner-occupation, age of housing, and the ratio of sales price to income. For the state overall, loans were more likely to be granted to non-Black borrowers, and on housing which was newer, owner-occupied, and where the borrower income was relatively higher with respect to the

sales price. Hispanic borrowers and locations within special studies zones were not disadvantaged overall.

These relationships are both more meaningful and significant at the submarket level (Table VI-1). In the San Francisco-Oakland SMSA, study counties for submarket analysis included San Francisco County, Alameda County, Contra Costa County, and San Mateo County. San Francisco County was included despite the fact that it lies east of the San Andreas fault and therefore does not contain areas within special studies zones. Alameda County is the site of the second largest city within the metropolitan area, Oakland, as well as numerous other densely populated residential areas. It also contains the fairly active Hayward fault. San Mateo county is bisected by the San Andreas fault, and contains a variety of well-established suburbs (Burns, 1974). Contra Costa County is chiefly suburban, although it includes several aging port facilities at Richmond and Martinez, inhabited largely by minority populations. The variables which seemed to have an independent effect on the lending decision in all four San Francisco-Oakland SMSA counties were age of housing and whether or not the borrower was Black. Age of housing detracted from the loan decision in the three suburban counties, but acted as a positive factor in the loan decision in San Francisco, a city where pre-1930's housing stock is highly prized for renovation. In three of the counties, the ratio of sales price to income strongly affected the lending decision. In all four counties, if the borrower were Black, the loan application would be more likely to be rejected than if the borrower were of some other race. Location in a special studies zone did not enter into the discriminant function in any of the four counties, nor was the t-test for difference in mean values significant, except in Alameda County where location in a special studies zone meant a *greater* probability of

Table VI-2 STATE AND COUNTY DISCRIMINANT FUNCTIONS

	STATE	COUNTIES			
		Alameda	Contra Costa	Los Angeles	Orange
Total loans analyzed	100,633	6107	5036	32,111	8633
In Special Studies Zone	9,972	1400	815	2,426	150
Number Granted	88,425	5369	4591	28,774	7903
Number Refused	9,911	738	445	2,596	730
T value for differene between granted and refused applications for:					
ratio of sales price to income	-7.42*	1.58	-2.35**	-14.37**	-6.82**
age of housing	6.07**	9.72**	2.87	5.43**	4.80**
owner-occupied	-3.32**	.38	-3.09**	-9.76**	-.72
Black borrower	-5.79**	-15.97**	-3.04**	-8.25**	-2.25*
Hispanic borrower	-1.06	-1.8	-1.22	-.13	-3.17**
location in special studies zone	-1.07	2.67**	-.67	-1.61	NA
Variables entered into the discriminant function:					
ratio of sales price to income	X		X	X	X
age of housing	X	X	X	X	X
owner-occupied	X		X		
Black borrower	X	X	X	X	X
Hispanic borrower	X	X		X	X
location in a special studies zone					
Percent of cases correctly classified by discriminant function	66.13	72.8	70.8	68.16	67.5

** significant at .01
* significant at .05

--Continued

Table VI-2 (Continued)

	COUNTIES					
	Riverside	San Bernardino	San Francisco	San Mateo	Santa Clara	Ventura
Total loans analyzed	2224	1833	2450	4315	6697	3392
In Special Studies Zone	521	497	0	630	829	0
Number Granted	2032	2662	2207	3875	6048	3102
Number Refused	192	171	243	440	649	290
T value for difference between granted and refused applications for:						
ratio of sales price to income	-3.23**	-2.10*	-3.86**	-6.88**	-3.43**	-.57
age of housing	.27	1.84	2.14*	1.62	2.86**	2.30*
owner-occupied	.98	-2.21*	.44	.54	-1.27	-2.73**
Black borrower	1.10	-.54	-4.38**	-4.04**	-3.11**	-2.07*
Hispanic borrower	-1.90	-.55	-1.17	-.24	-.74	-.30
location in special studies zone	3.06**	-.84	NA	1.24	.92	NA
Variables entered into the discriminant function:						
ratio of sales price to income	X	X	X	X	X	
age of housing		X	X	X	X	X
owner-occupied		X			X	X
Black borrower			X	X	X	X
Hispanic borrower	X		X		X	
location in a special studies zone	X	X			X	
Percent of cases correctly classified by discriminant function	62.1	64.3	69.4	74.4	65.1	68.9

** significant at .01

* significant at .05

the loan being accepted. This finding is corroborated by a previous study by the author (Palm, 1981) which showed that in portions of Alameda County, house prices rose proportionately more within special studies zones than in other areas during the years between 1972 and 1977. Although the presence of a "view lot" was included in these equations, the effect of this variable very possibly was insufficient to capture the importance of these architecturally unique properties in the hills of Oakland and Berkeley located in the special studies zone surrounding the Hayward fault trace. In any case, it would seem doubtful that in this county, the special studies zone itself would have a perversely positive impact on house price trends nor on the probability of favorable loan decisions, regardless of the observed statistical relationship. If this were the case, then the claim by Brookshire and Schulze that consumers are sensitive to differences in the safety of special studies zone vis a vis other locations (Brookshire and Shulze, 1981) is even further damaged; rather than make such a claim, it is more plausible to suggest that the statistical function is incompletely specified, and that some other aspect of location in the Berkeley and Oakland hills contributes both to the value of property therein and to the likelihood that loans are favorably received in these areas.

Orange County is the location of the Anaheim-Santa Ana-Garden Grove SMSA. The special studies zone here is limited to the southeastern portion of the Newport-Inglewood fault which, according to FEMA, has a moderate probability of an 8.3 magnitude earthquake sometime during the next 20 years. Huntington Beach is the major settled area through which this zone passes, and no homes were sold within special studies zone tracts during the study period. Lending decisions in Orange County seemed to be affected by the ratio of sales

price to income, age of housing and race of ethnicity of the borrower. Loans to Black or Hispanic borrowers or secured by older property were more likely to be rejected.

The Los Angeles-Long Beach SMSA is included within Los Angeles county. There are several special studies zones within the county including those along the San Andreas fault, the San Fernando fault, the Raymond Hill fault, and the Newport-Inglewood fault. The most serious threat to population here is an earthquake on the Newport-Inglewood fault, which passes just to the west of downtown Los Angeles, and extends from Beverly Hills on the north, through Culver City, Inglewood, Watts, Compton, Signal Hill, and Long Beach. The San Andreas fault crosses the county far to the north of the major population concentration, just south of Palmdale. In Los Angeles County, lending decisions were most strongly related to the ratio of sales price to income, age of housing, and race of the borrower. Older houses, and Black or Hispanic borrowers were less favored in the lending decision. Special studies zone location was only weakly related to the lending decision, and this relationship was not statistically significant.

The Oxnard-Ventura SMSA is included in Ventura County. Active faults in the county include the Big Pine fault, running through the northern portion of the county, and the Oak Ridge fault, located just south of the city of Ventura. In Ventura County age of housing, whether the house was to be owner- or renter- occupied, and race of the borrower had the strongest effects on the lending decision. Non-owner-occupation, older housing and black borrowers were less likely to elicit a favorable loan decision.

Santa Clara County contains the San Jose SMSA. This metropolitan area is made up of a large number of suburban communities in the Santa

Clara valley, as well as several older agricultural trading towns such as Gilroy. It is dissected by three faults: the San Andreas fault in the far west, the Hayward fault in the north, and the Calaveras fault, passing through the center of the county. Lending decisions here were strongly affected by the age of housing, the ratio of sales price to income, and the ethnicity of the borrower, although the discriminant function also included location in a special studies zone as well as owner occupation. Loan applications by Black borrowers and on older housing were less likely to be granted. Applications in the special studies zone were slightly more likely to be accepted, but again the t-test for this variable was not statistically significant. Here too we have the confounding influence of newer housing on rolling terrain being constructed within the special studies zone in the western part of the county (in Redwood Estates and Saratoga, for example), reversing the "expected" impact of special studies zones on the lending decision.

The SMSA which contains the greatest danger of major damage to residential structures and loss of life over the next 20 years according to FEMA is the extensive San Bernardino-Riverside-Ontario SMSA encompassing San Bernardino and Riverside Counties. The heavily populated western sections of these counties contain both the San Jacinto and the San Andreas faults. Once again, FEMA has stated that an earthquake of magnitude 8.3 or above on this portion of the San Andreas fault is highly likely within the next twenty years. The San Jacinto fault runs through Hemet and San Jacinto in Riverside County and Muscoy in San Bernardino County. The San Andreas fault runs through San Bernardino and Devore in San Bernardino County, and several desert communities including Morongo Valley, Desert Hot Springs and North Palm Springs in Riverside County. For San Bernardino County, owner-occupation and the ratio of sales price to income had statistically

significant values for "t." In Riverside County, location with respect to a special studies zone had a statistically significant "t" value, but as in Alameda County the sign was the reverse of that expected: loan applications within the special studies zone were more likely to be accepted than those on property outside the zone. Again, this is no doubt a reflection of the expansion of the desert communities in the Palm Springs region rather than an expression of preference for the zones.

Summary

In the state taken as a whole, and in urban submarkets approximated by counties within the major SMSA's, a set of variables seems rather consistently related to the lending decision. First, except in San Francisco County, lenders tend to act favorably on loan applications for new housing rather than older housing. Second, ethnicity and race of the borrower has an impact on the lending decision in several of the counties: Hispanic borrowers are less likely to receive a favorable loan decision in Alameda, Los Angeles, Riverside, and Santa Clara counties than Anglo borrowers, and Black borrowers are more likely to receive a negative decision in all but San Bernardino County. The ratio of sales price to income is related to the lending decisions only in Alameda, Los Angeles, San Bernardino and San Francisco counties, contrary to expectations based on the rational decision model. Finally, location in a special studies zone is related to the lending decision as an individual variable in Alameda and Riverside Counties, but the sign of the relationship is reversed: property located within the zones is more likely to receive a favorable decision than that outside the zones. In sum, location in a special studies zone does not seem to have a negative impact on the lending decision; indeed, it seems to have no impact at all. This finding is

not surprising given the size and diversity of the special studies zones, and the survey responses of lenders and appraisers reported earlier. We therefore have evidence both from survey data and from information on correlates of lending decisions that location in a surface fault rupture zone does not affect the evaluation of that property by lenders. Mapping of these areas has not resulted in a change in lender behavior or a tendency to avoid investment in the zones. These findings have both theoretical and policy implications which will be explored in the final two chapters.

CHAPTER VII THEORETICAL IMPLICATIONS

Sallie Marston and Risa Palm

In recent years there has been a growing discontent with the traditional framework for explanation in academic natural hazards research. The standard model of individual bounded rationality has been criticized for being limited in its scope of analysis. The traditional approach has been cast in a human ecology model, portraying the world as a complex set of interactions between physical and human systems which exist, ideally, in a state of dynamic equilibrium. In actual fact, human systems of resource utilization may upset a delicate equilibrium causing changes in the physical system. Under extreme circumstances the resultant disequilibrium may create a hazardous or disastrous situation.

The traditional approach focuses on how and why decisions are made within the human system. Explanation is loosely based on a theory of corporate decision making developed in the 1950's (Simon, 1957). A description is supplied by Kates who views bounded rationality and human ecology as:

> an interaction of man [sic] and nature, governed by the coexistent state of adjustment in the human use system and the state of nature in the natural events system (Kates, 1970, p. 1).

Furthermore:

> Variation in the perception of a specific natural hazard (expectation of future occurrence and of personal vulnerability) can be accounted for by a combination of: the way in which characteristics of the natural event are perceived, the nature of personal encounters with hazard, and the factors of individual personality (Kates, 1970, p. 6).

It seems that insufficient or imperfect knowledge or misperception may result in a decision which places the human system in a position of vulnerability relative to extreme events in the natural or physical system.

This explanation places the human system in a central role, emphasizing population as the independent variable in the population-extreme event relationship. Although population or the operation of the "human system" may interfere with the operation of the physical system, the explanation fails to successfully incorporate the social, political, economic, and cultural pressures which constrain individual rationality and provoke disastrous situations. Most of the critics of this approach argue that individual action must be de-emphasized, and constraints on decision making should be highlighted.

The thrust of the criticism has been based on the assertion that traditional research has failed to conceptualize within its model how political, social and economic *structures* are likely to amplify the effects on population of extreme physical events. The "structures" to which these critics refer are actually simplified theoretical constructs which represent very complex empirical referents. It is argued that political and economic processes exert a significant influence on individual behavior: the way a society reproduces itself through the operation of its government and economy can create both opportunities and constraints on individual action. For instance, the provision of federal flood insurance enables individuals to occupy traditionally floodprone areas. The federal government thus provides many individuals with the opportunity to inhabit these potentially hazardous areas by underwriting part of the recovery costs involved in living in flood hazard areas. Without such subsidies, a household may be financially unable to buy insurance to protect its real estate investment. This may be the case in areas susceptible to damage or loss due to an earthquake. Government action may thus influence individual behavior, and the structure of political, economic and even

cultural processes within a society may be seen as real though not easily identifiable influences on individual behavior.

Yet, it appears that the critics of the traditional approach may be erring in the opposite direction by placing too much emphasis on structural constraint. In other words, there has been a tendency to place a singular emphasis on structural explanation while ignoring the possiblity of effective individual action to overcome inherent structural constraints. It has been pointed out that "macroscale social structures should be precisely defined, that they do not have autonomy or an existence that is not ultimately reducible to cumulative human actions and interactions, and that processes linking structure or context and individual or social action need to be carefully specified (Duncan and Ley, 1982, p. 32)."

The result of the controversy outlined above has been a polarization, with one community of researchers continuing to devote themselves to examining individual hazards choice, perception and adjustment, while the other seeks explanation by examining the structural constraints on action. While the traditional school certainly recognizes the role of structure in contraining and providing opportunities for individuals it is admitted that "[m]any of the real determinants of human behavior related to natural hazards lie outside the interface of the natural system and the human system" (Kates, 1970, p. 25), and consequently has failed to incorporate them into the model. Also, those researchers who emphasize structure and the attendant social, political, economic, and cultural constraints have tended to seriously undervalue the possibility for human action to alter those constraints.

The empirical findings reported in the previous chapters have reinforced the explanatory inadequacies inherent in both approaches.

For example, structural constraints and enablements such as competition, high lending rates, government regulations and many other political and economic factors were cited as obstacles to adopting hazard mitigation measures or as reasons for not needing private mitigation schemes. However, despite these constraints and enablements such as Small Business Adminstration disaster loans, more than a few lending institutions rose above these "structural" factors, and had taken steps to attempt to protect their portfolios and make them less vulnerable to potential earthquake losses. Furthermore, it was evident that within a lending institution, a particular individual or individuals could be instrumental in advocating the adoption of an earthquake response policy.

Given the interactive capacity of both individual action and structural constraint and enablement, theories of individual bounded rationality or structuralism cannot accurately represent the complex set of interactions involved in the decision making of lending institutions relative to the earthquake hazard. Rather, it is necessary to adopt a theoretical approach that recognizes the interactive nature of individual action and structure, and also is capable of unravelling the complexity of this process. We must be able to conceptualize the actual process of individual decision making as it is informed by the structure.

The decision-making framework of the loan executive can be represented as a tripartite scheme wherein the individual interacts with the institution, and at the same time both interact with the larger society. The individual may simply follow the prescribed rules and resources dictated by the institution but may also argue for some changes in the rules and resources governing the functioning of the institution. In this, the individual may change the institution and

the society, albeit in but a small measure. Change may also occur in society itself, leading to changes in the institution and ultimately the individual. This process is ever-evolving. A theoretical model which attempts to account for this pattern of interaction and change must emphasize two factors:

(1) the constraints and opportunities that exist within the structure of institutions and society, and

(2) the unique influences of individuals on institutions and society which can affect and be affected by the constraints and opportunities of the structure.

In this decision-making environment, the loan executive's attitudes and behaviors influence and are influenced by the rules of the institution as well as by the operation of the wider social structure. It is important to recall that underlying the complexity in the functioning of the institution and society are a set of rules and resources, a *structure*, within which the executive finds both opportunities and constraints. In addition, there is a status hierarchy which is in existence at the time any executive makes a new decision, a hierarchy which both reflects previous decisions and will be affected by new decisions. This hierarchy normalizes relationships of interdependence among individuals within the lending institution, and is therefore a *system* of behavior and information exchange (Giddens, 1979).

Individual bounded rationality seems an appropriate empirical device for the collection of information on expressed attitudes and behaviors. This level of analysis alone is insufficient however, given the influence of structure. The constraining and enabling environment within which these individuals operate must also be examined. At this level the study sought to determine how financial institutions qua

institutions influence the hazard vulnerability of the general public, using a managerialist model.

In the following section, *managerialism* is described. It is suggested that *structuration*, a theoretical approach which conjoins the development of individuals and institutions, might provide a useful descriptive framework.

Managerialism and Natural Hazards Research

The managerialist thesis, as it was originally put forward, asserts that managers or gatekeepers are key individuals within powerful institutions, such as government bureaucracies in the public sector and financial institutions in the private sector. Because these individuals play a powerful role in allocating resources, their beliefs and actions should be studied.

The managerial thesis was subjected to criticism on the grounds that it was not really a theory, but merely a specification of empirical data that should be collected. It was argued that in focusing on the way in which managers control access to resources, the managers are presented as autonomous decision makers. This emphasis failed to identify how institutional and managerial behavior is mediated by and constrained by larger political and economic forces. Marxian structural theorists such as Harvey (1975), Williams (1978), and Basset and Short (1980) pointed out that managers are themselves constrained by the economic, social, and political priorities of capitalism. Managerial behavior, therefore, could not be analyzed independently of a wider social theory based on the functioning of the political economy.

However, as Saunders (1981) and Giddens (1979; 1981) have indicated, the Marxian structural approach is not without its

problems. For example, in its emphasis on economic relationships, it ignores ideological aspects of society such as racism or sexism, issues which have been important in accounting for some of the behavior of real estate managers. Second, the "needs" of capitalism are reified in Marxian analysis, leading to fairly tidy structural-functional arguments that are empirically untestable. Thirdly, although there is discussion of the forces leading to societal change, there is little room in Marxian theory for a consideration of the impacts of individuals on the structure.

What is needed is a theory which is able to conceptualize the reciprocal relationships between individual action and structure. Such a theory permits the investigation of the effects of such relationships at the institutional level. As Williams (1982, p. 101) has put it:

> The fundamental problem for both development of theory. . . and . . . for an adequate conceptual framework for analysis of institutional activity then lies in resolving the relationship between the social structure as a whole and its constitutent parts.

Structuration Theory and Natural Hazards Research

To analyze the complex "social structure as a whole and its constitutent parts," one must be able to connect the subjective orientation of action to institutional structures. The research reported here requires a specific examination of risk-taking behavior while recognizing the mediating effects of the social structure. Structuration theory synthesizes insights from behaviorism and structuralism (including managerialism and Marxian thought) and examines the important interactive quality of action and structure. As Giddens (1977) points out:

> The production of interaction can in this way be treated as an active, contingent accomplishment of social actors, grounded in the reflexive rationalization of action located contextually (130).

Individual action (agency) and structure are produced mutually.

The most important aspect in structuration theory is the rejection of the notion that individual action is unconstrained or, conversely, that it is structurally determined. But also of importance is that structuration recognizes a distinction between system and structure. An example of *system* is the status hierarchy of a financial institution: from clerks and tellers up through loan officers and departmental supervisors to board members. In the context of lending and earthquake hazards, the relative positions and the concomitant roles of individuals within the financial institution are the components of the system. The *structure* behind the system consists of the rules and resources which mediate the behavior of individuals within the lending institution. For instance, the norms governing career advancement are significant influences on attitudes and behaviors. Individuals employ structural rules and resources to create and reproduce the structure. Structuration takes this impact of individual transformation of the structure into account (Table VII-1).

Table VII-1 STRUCTURE, SYSTEM AND STRUCTURATION

STRUCTURE	Rules and resources organized as properties of social systems. Structures exist as "structural properties".
SYSTEM	Reproduced relations between actors or collectivities, organized as regular social patterns.
STRUCTURATION	Conditions governing the continuity or transformation of structures, and therefore the reproduction of systems.

A specific example from the study should serve to further clarify the main contours of the structurational thesis. A representative of a small savings and loan institution in the San Francisco Bay Area indicated that the lender had a definite earthquake hazard lending policy. The policy was that any mortgage on a home located in a designated special studies zone had to have a requisite amount of earthquake insurance. A high level officer within that institution had been motivated both by personal experience and government action to argue for the implementation of this policy. A large portion of this institution's portfolio was geographically concentrated in special studies zones, and the institution had adopted its policy soon after the Alquist-Priolo Special Studies Zone Act was enacted. To paraphrase Giddens within this context, the adoption of the earthquake hazard mitigation policy can be seen as an active and contingent accomplishment of a high level officer who recognized its usefulness and necessity, given both the state government's concern as well as personal experience with earthquake losses.

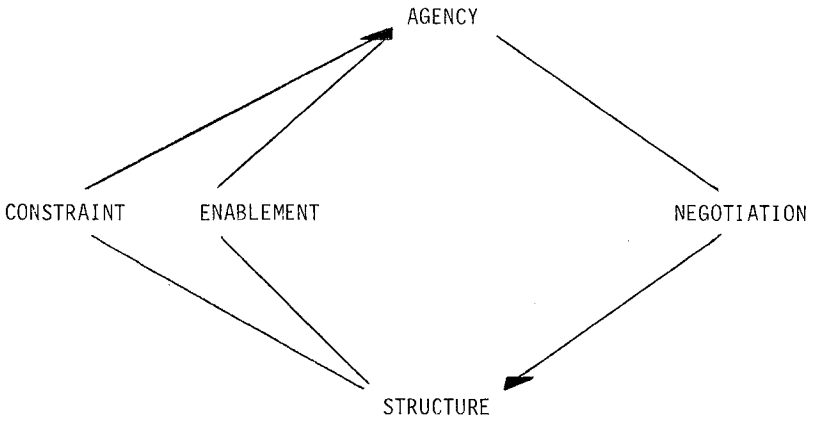
Several other aspects of Giddens' theory help to account for this study's empirical findings. First, structuration theory emphasizes the importance of understanding the rules and resources used by agents in any institution. In the case of financial institutions, it is important to understand attitudes and behaviors of loan officers, and also the role that individuals can have in effecting changes in institutional policy. Interpretations of survey findings in this project are complicated by the fact that executive vice presidents interviewed might either determine or simply implement policy. In the case of the latter, individual risk perceptions might influence personal actions, but might not be translated into institutional policy. Although there is a statistical relationship between

individual risk response among the lending officers and the responses of the institution to earthquake hazards, the causal connection between these observations is not clear; it cannot be stated with certainty that the individual beliefs and perceptions of a given loan officer have had a determining effect on institutional policy. A more detailed study of a small number of institutions is called for to determine the history and directions of such relationships.

Second, structuration theory highlights the effects of the interactions between individuals and structures for the evolution of rules that govern systems. The study reported here provides only an isolated frame in a sequence which produces an evolving pattern, a characteristic of any survey research which is not done repeatedly for the same institution at short intervals. However, it is still possible to identify transformation in the process of hazard awareness and attendant behavior. At the time of the 1906 earthquake in San Francisco, few lenders considered protecting their portfolios against earthquake risk. In 1982, several large lenders responded to the earthquake threat by adopting policies to deal with it. Thus, the structure has changed, in part, the product of individual hazard awareness on the part of key decision-makers. The correlation between attendance of lending officers at hazard seminars and higher levels of hazard perception and concern may also demonstrate the importance of exposure of agents to information from the environment, and resulting changes in institutional policy. Again, the causal connections are not clear, but the empirical relationship seems worth pursuing, and is best framed within the structurational theoretical framework.

The theory of structuration reminds us that the relationship between human agency and structure is interdependent, and mutually effective. Figure VII-1 illustrates this point.

Figure VII-1 RELATIONSHIP BETWEEN AGENCY AND STRUCTURE.



The connection between agency and structure is often mediated through the rules and regulations of institutions having either a constraining or enabling effect on human practice. For example, the political structure, through anti-trust and anti-redlining legislation may constrain financial institutions from requiring the purchase of earthquake insurance by the mortgagor. On the other hand, the political structure through the California state lending code may enable lenders to avoid earthquake hazard areas if they can demonstrate that there is a hazardous condition threatening the security property (Palm and Corbridge, 1983). Additionally, the relationship does not operate unidirectionally from the structure to the individual. Individuals can affect government policy through lobbying efforts, just as the government affects the individual through regulations. Furthermore, individuals may operate independently of the structure, as illustrated by the number of lenders who have adopted their own earthquake hazard policies.

Finally, this theory demands that the researcher be wary of a literal interpretation of survey responses. This requires that we recognize that the "reflexive monitoring of behavior operates against the background of the rationalisation of action" (Giddens, 1979, p. 57) or or, in other words, that behavior is not easily rationalized and reported by the respondent.

FIGURE VII-2 REFLEXIVE MONITORING OF BEHAVIOR AND RATIONALIZATION OF ACTION.

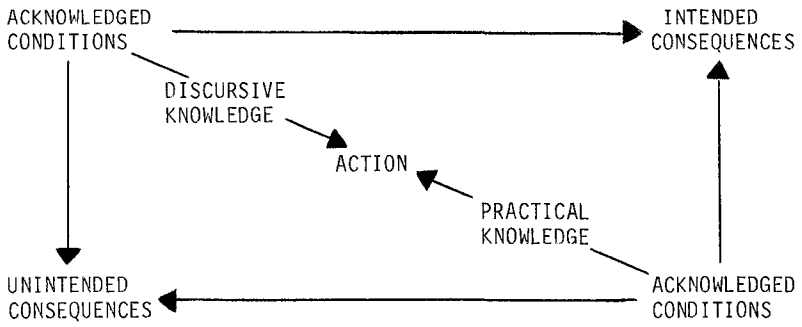


Figure VII-2 represents how actors draw upon knowledge to articulate the reasons for action, and the consequences and conditions of their conduct. Specifically, *reflexive monitoring* is the capability of actors to explain what they are doing. For example, an interviewee may explain how his/her institution adopted an earthquake hazards policy by articulating the various motivations and experiences which led to a particular course of action. *Rationalization of action* is the actors ability to give the reasons for what they are doing: to give an account of past behavior as viewed from the present. In this case, the response is a verbal reaction, not necessarily linked to past behavior. The actor may give incomplete or inaccurate information. A specific example is of the interviewee whose institution has no

earthquake hazard policy. The interviewee offers immediate and unreflexive responses to questions he/she has never contemplated before. As figure VII-2 indicates, reasons offered for particular actions relate to acknowledged as well as unacknowledged conditions (unconscious motives). Furthermore, acknowledged and unacknowledged conditions have consequences which may be either or both intended or unintended. As Giddens points out:

> The giving of reasons in day-to-day activity which is closely associated with the moral accountability of action, is inevitability caught up in, and expressive of, the demands and the conflicts entailed within social encounters. But the articulation of accounts as reasons is also influenced by unconscious elements of motivation (1979, p. 58).

Thus the rationalizations that lenders supply for their earthquake hazard behavior are likely to be incomplete accounts extracted from a much wider context of action. It is therefore impossible to obtain a complete account of the reasons for lenders' behavior relative to the earthquake hazard.

Summary

Research on the response of lenders to environmental uncertainty, in this case earthquake hazards, requires a theory which is capable of accounting for the complex interrelations between individuals, institutions, and society. Giddens' theory of structuration, emphasizing the interactive and mutually transformative nature of human agency and structure, coupled with an empirical emphasis on urban managers, seems best able to provide a framework for an understanding of institutional response to hazards.

Structuration theory emphasizes the complexity of relationships between actors and collectivites, encouraging the researcher to examine the rules and resources governing such relationships. The theory also provides a method of accounting for the transformation, production, and

reproduction of the system. It moves beyond explanations which focus on individual response or on the "needs" of the system, enabling the identification of sources of decisions and their impacts, affecting all levels of the interactive framework. In a policy sense, this theory may also help the planner to identify areas where attempts to influence attitudes and behaviors may have the greatest impact.

CHAPTER VIII

THE RESPONSE OF APPRAISERS AND HOME MORTGAGE LENDERS TO EARTHQUAKE HAZARDS: IMPLICATIONS FOR POLICY

The empirical study of appraisers and California lenders has yielded complex and sometimes contradictory results. In general, appraisers and lenders vary in the extent to which earthquake hazards are said to be integrated into the appraisal and underwriting process. Market performance, however, shows little evidence of any such integration on the part of lenders.

The majority of appraisers interviewed indicated that they routinely investigated whether a subject property was located in a special studies zone or landslide-prone area. They indicated that such a factor would be noted in the appraisal report, and in the case of special studies zones, the "comparables" would also be checked. However, most appraisers do not identify any price adjustment resulting from such location, indicating that while the factor may be described in the appraisal, the house price will be estimated as if the hazard did not apply to the property. While most indicated that they would investigate whether the dwelling unit had suffered damage from seismic activity, and would note this factor in the appraisal report, few would attempt to integrate this information in checking comparable sales or would identify a related price adjustment. It is also possible for damage to the dwelling unit in the form of cracked walls or ceilings to be noted, but not attributed to any recurring geologic condition, a practice which would further mask the reporting of relevant earthquake hazard information. The majority of appraisers said they would not check to see if a property was on a surface fault trace, and virtually none would make a price adjustment based on this condition. What this

means is that the key professional involved in what should be an objective valuation of the property for the buyer, seller, and lender, may routinely overlook seismic conditions as a matter of practice. Again, it must be stressed that the appraiser takes this position because of his/her belief that "the market" does not need or use such information. If this type of information were routinely demanded because of buyer concern, lender practice, or a regulatory condition (such as is the case for mandated flood insurance), appraisal practice would adjust to include it. At present, however, even the careful buyer who attaches a condition of a satisfactory appraisal to the purchase agreement, may not receive information about seismic conditions as part of the appraisal report unless such information is specifically requested.

The majority of lenders never or rarely make adjustments in lending terms on the basis of the fact that the property is in a landslide-prone area, because of evidence of seismic damage, or, in California, when the property is in a special studies zone or known to be underlain by a surface fault trace. California lenders seemed more reluctant to make loans on houses of unreinforced brick or in landslide areas than in special studies zone locations, or even on property evidencing damage from previous earth movement. Lenders in both states ranked earthquake hazard as the least likely of five possible causes of mortgage default, and most lenders in both states felt that even after a major damaging earthquake, less than 10 percent of their mortagages would be in default; in California, almost one-fourth of the lenders felt that virtually none of their mortgages would default even after an 8.3 magnitude earthquake (Table V-7).

This attitude by the majority of lenders seems to be reflected in analysis of the data set made available by the California Department of

Savings and Loans. In the statistical analysis of the correlates of positive and negative lending decisions, a clear pattern of concern with age of the dwelling unit, race or ethnicity of the borrower, and to a lesser extent the ratio of sales price to total income emerged. What was clearly not present as a factor affecting the lending decision was location within a special studies zone. Because of insufficient detailed data on other relevant characteristics, this analysis can provide only a crude picture of the lending decision patterns, but is sufficient to indicate that there is no evidence to suggest a pattern of avoidance of lending in the zones.

What may be significant from a policy perspective is an understanding of the minority of lenders who do make loan modifications or even refuse to make loans in seismic risk areas or on houses showing damage from previous seismic events. These individuals are generally personally concerned with earthquakes (they would consider seismic hazard in selecting their own house and have earthquake insurance policies on their own houses), are more conservative in lending policies, have attended earthquake hazard seminars, and feel that it is the lenders responsiblity to inform buyers about earthquake hazards. Some of these characteristics may be used to attempt to encourage more awareness and response to earthquake hazards on the part of lenders.

Why is there not Greater Concern within the Financial Community: Some Myths and Facts

It has been alleged that lenders do not take earthquake hazards into account because they are not actually at risk. Several arguments have been put forward to support this position. First, because most loans are made on post-1940 houses which have been built according to some seismic building code, there is little actual susceptibility of

single family residential dwellings to major earthquake-related damage -- damage would not exceed the homeowner's equity, protecting the interests of the financial institution. Second, even if the property sustains major damage, it is unlikely that the borrower will default so long as there is positive net equity in the home. Third, lenders are assumed to spread their risk vulnerability over a wide range of investments and over a sufficiently large georgraphic area that even if there were a major earthquake in one part of the state, their portfolio would not be subject to major losses. Fourth, lenders tend to purchase earthquake insurance on their portfolios, protecting themselves from catastrophic losses in the event of a series of defaults. Fifth, lenders who sell mortgages on the secondary market have passed on the risk of default elsewhere. Sixth, it is assumed that lenders are counting on aid from the state and federal government to permit them to provide bridge loans to disaster victims, or other low-interest financing to permit borrowers to continue mortgage repayments. Seventh, because of state and federal anti-redlining legislation, lenders are unable to make use of available geologic information for lending decisions if the result is geographic mortgage discrimination. Eighth, anti-trust legislation would seem to prevent lenders from taking parallel action to modify lending conditions if such action follows from direct conversations among the lenders. Because of the weight of these arguments, particularly when taken together, it is important to examine the extent to which each of them is valid.

The first argument, that most loans are made on recent housing which is in compliance with rather strict seismic building codes, is an important one which may indeed affect the response of lenders. It is true that older structures are far more susceptible to collapse in a major damaging earthquake, that these are the buildings that will cause

greater danger to residents, and that some attention should be given to these buildings in upgrading their structural resistence or retiring them from use as residential structures. However, it is to be recalled that magnitude 8.3 earthquake on the San Andreas fault in the San Francisco Bay area would produce a shaking intensity of 10 on the Rossi-Forel intensity scale in which, by definition, "some well-built wooden structures are destroyed, and most masonry frame structures are destroyed with foundations" in sections of the Bay Area including portions of Daly City, Foster City, Redwood City, Mountain View, Santa Clara, Sunnyvale, San Jose, Sausalito, San Rafael, and portions of downtown San Francisco (Davis *et al.*, 1982). A damage intensity of 9 or 9.5 (damage considerable in specially designed structures; well-designed frame structures thrown out of plumb") would be widespread in the Bay Area. In southern California, an 8.3 earthquake on the Southern San Andreas fault would produce a damage intensity of 9 in portions of San Bernardino, Colton, Altadena, Sunland, and Palmdale (Davis *et al.*, 1982). For comparison , it is useful to recall that the 1971 earthquake in San Fernando was only magnitude 6.4, with a damage intensity near the epicenter ranging from 8 to 9. In other words, the 8.3 earthquake on which emergency planning has been based will indeed do major damage in portions of the Los Angeles region, and major damage in much of the San Francisco Bay region, even to less substantial wood frame dwellings. Although moderate earthquakes (magnitude 4-5) may result only in damage levels of 7 or less (negligible in well-designed and constructed buildings), there will be considerably more damage in the "great" earthquake, an event which is far from improbable in both northern and southern California. The lender concerned with a long-term interest in the property (from 10-30 years) should therefore be responding not only to the probable moderate event, but also to the

very real possibility of the "great" event, which would indeed cause major damage to single family residential structures.

The second argument is that even faced with a major loss of value in the property, the rational homeowner will still not default as long as there is positive net equity in the property. At the time of this writing, a study of the factors leading to unexpectedly large number of defaults following the 1971 San Fernando earthquake is still in progress. However, early papers from this study suggest that homeowners might still default if (1) they were intending to move anyway and were already having difficulty selling the house, (2) they believed that they would not be prosecuted for the default and would be able at some future time to obtain another mortgage loan, and (3) if there are severe disadvantages in staying in the local area because of general destruction to the neighborhood, a loss of local job prospects, and the absence of accomodation on the part of local mortgage lenders (Weinrobe, 1983a; Weinrobe, 1983b). It is probably true that most "rational" homeowners will not default if there is positive net equity in the property. However, the distribution of "rational" individuals in the population, and the disposition of property where there is not positive net equity (in regions subject MMI of 9, 9.5 or 10), are not a certainty and therefore pose a significant risk to the lender.

The third argument, concerning the spreading of risks over a wide range of investments, is more true for commercial banks than for savings and loans. For the commercial bank, the lending portfolio may be limited to a few home mortgage loans at any given time, and these loans may be on widely spread property. For the savings and loan, however, regulatory requirements have demanded a portfolio concentration in local home mortgage loans. While the larger savings and loans, with branches throughout the state and linkages with

out-of-state corporations, might well count on a geographic portfolio diversification, the smaller savings and loans will have their portfolios concentrated in a rather circumscribed geographic region. Almost one-fourth of the California lenders stated that 26 percent or more of their mortgage loan portfolio would be in default in the event of a major damaging earthquake, a not insignificant threat to the financial stability of the institution. As has already been noted, this response was statistically related to other indications of awareness of the earthquake hazard and modifications of lending behavior based on seismic risk.

The fourth argument concerning portfolio insurance was shown to be simply untrue. Only eight of the lenders carried earthquake insurance on their portfolios, and of these, six were among the top 30 California lenders. While the largest lenders may indeed insure their portfolios, the smaller and more vulnerable lenders do not carry such insurance.

The fifth argument, that lenders resell packages of mortgages on the secondary market and are therefore absolved from default-risk, is only partially true. Mortgage originators continue to collect payments and do the paperwork on loans they have originated, and to collect a fee for the servicing of the loans. In the case of default, this servicing function and its associated fee would be lost to the originator. In addition, of course, the secondary purchaser might cease doing business with the originator, or would undoubtedly set new terms for their financial arrangement. But it is true that the risk of default here would be aggregated to the bundle of mortgages in the package, and would be passed on to those investing in the secondary mortgage market. The willingness of secondary investors such as Freddie Mac and others to purchase uninsured mortgage packages originated in earthquake-prone areas is truly another factor which

permits the existing process of ignoring the earthquake hazard to continue.

The sixth argument was shown empirically to be untrue. Although lenders may expect some state and federal aid to disaster victims which will help insure their continued financial stability, most do not feel that this aid will be sufficient to fully reimburse households for their losses. It is also not obvious that such aid would be automatic, particularly if the state or federal government faced concurrent pressing financial problems or other crises.

The two legal arguments -- that antitrust and antiredlining legislation prevent lenders from using geologic information to discriminate against regions, or to initiate industry-wide loan conditions -- are valid constraints on lender behavior. One might assert, however, that either constraint could be modified by new legislation or exemptions permitting loan modifications under certain conditions. Were there sentiment among the lenders to press for this legislation, it is likely that their efforts would be rewarded at the state or national capitol. The legal arguments are indeed constraints, but not overwhelming barriers to changes in policy: they could be overcome by lobbying attempts by the financial community, should lenders feel that these barriers needed modification.

It has been argued that the set of assertions used to justify inattention by lenders to earthquake hazards are only partially valid at best, and completely false at worst. Together they may justify a decision *post hoc*, but should be be interpreted as causal and certainly not irrevocable in affecting lender behavior. It is demonstrably in the lender's best interests to take earthquake hazards into account when making lending decisions. Although the actions they might take to mitigate their own vulnerability might not directly reduce the

vulnerability of homeowners, several lender policies could have exactly that effect. The question is then: how can lenders be induced to pay more explicit attention to seismic risk?

Inducements to Change in Lender Behavior

The survey of lenders and appraisers has yielded insights into their attitudes towards seismic risk and the feasibility of greater participation of lenders and appraisers in the process of informing homebuyers about earthquake hazards or themselves taking measures to mitigate some of the more disasterous financial consequences of a major damaging earthquake. Although we had anticipated that the regulatory environment, particularly fair lending laws, would have been perceived as a major barrier to a change in lending policies, this was not mentioned by the lenders interviewed. While it does seem true that such legislation may restrict the scope for geographic discrimination based on geologic conditions if these conditions are spatially associated with concentrations of minority populations, it is equally apparent that legal constraints can be overcome in the courts if not in the legislative process.

We have found strong evidence that lenders who had attended government- or privately sponsored meetings concerning earthquake hazards were more likely to integrate earthquake hazards into their personal behavior as well as in professional evaluations of property. We do not know the causal sequence of this relationship; that is, whether those who were already concerned with earthquake hazards were more likely to attend the seminars, or whether the seminars themselves had an independent effect in inducing hazard awareness. This finding, however, should encourage agencies such as FEMA, the California Seismic

Safety Commission, SCEPP and other organizations to continue in their attempts to reach influentials within the private sector.

Appraisers seemed anxious to obtain micro-zonation maps with which they could evaluate the hazard for individual parcels. Lenders also seemed interested in using such maps, were they available. However, until more precision can be attached to a prediction with a given time-frame, the publication of such maps might produce more confusion than clarification.

What implications do these findings have for policy? The empirical findings listed above are piecemeal, and do not outline major directions for a policy which would induce financial institutions to take mitigation measures that would be both in their own self-interests and those of the homebuying public. To achieve such public policy goals, several options are available. On the one hand, strict land use regulations or lending regulations could be devised to ensure that structural reinforcements were achieved, that earthquake insurance was universally adopted, and that lenders or others uniformly disclose the best possible information and evaluation of seismic characteristics of sites to homebuyers. At the other extreme, policy could treat seismic safety as an economic good to be managed by "the market." The latter policy would be informed by professional ethics of appraisal and financial institutions, as well as by liability law, but would not involve specific disclosure or land use regulations. Both extremes have advantages and disadvantages. A regulatory policy would be difficult to enforce and monitor, and would also be expensive to administer. Relegating policy to the market assumes that individual homeowners can obtain and process sufficient information to make rational decisions. Sarin (1982, p.22) has summarized these arguments:

> The arguments in favor of regulation are often based on the imperfection of the market caused by the inability of the people to process information about risks, the greed of some who may unfairly take advantage of others, and that at certain levels of risk, safety is not an economic commodity but a basic right of all members of the society. The arguments in favor of market mechanism often rest on the premise that in a capitalistic country, government should not adopt a paternalistic attitude and that a majority of the market imperfections can be corrected by supplying information to the consumers or by instruments other than regulations that require what to do and how.

There is no clear directive in policy formulation in a mixed economy: although the state is considered to be responsible for general public safety, it seems reluctant to invest major resources into monitoring regulations, preferring market to regulatory mechanisms.

Kunreuther (1983) has proposed a set of four possible states of regulation in seismic hazard public policy formulation. The first is hands-off policy by government, permitting the market to correct itself. With respect to the flow of information to homebuyers or encouragement to take mitigation measures, the market mechanism does not seem to be correcting itself with respect to seismic hazards. The second state is the provision of incentives to encourage self-correction. Incentives might include tax breaks or subsidization of activities by government. In the case of seismic risk, subsidies might include either voluntary or mandatory subsidized earthquake insurance. If a voluntarily-purchased earthquake insurance were provided, one might hope that homebuyers would find the price appropriate to decide to purchase the insurance. However, since Kunreuther has already demonstrated that individuals may be insensitive to a low price if they do not perceive the hazard as salient, any price might be too high for voluntary earthquake insurance adoption. In this case some type of mandatory earthquake insurance might be adopted in a plan similar to that in effect for flood hazard areas, operated either by the State of California or by the federal government. Such an

option falls in the third state of regulation: the specification of liabilities with associated penalties to encourage the adoption of mitigation measures. Among other such measures, these could include appraiser liabilities for the non-disclosure of seismic hazard associated with a site when such hazard has been mapped and knowledge is publicly available. Lender liabilites for non-disclosure would also no doubt follow were a mandatory earthquake insurance policy put into effect. The final and most extreme state of regulation would be legislative or judicial constraints on construction, land use, or occupance of particular area.

Although there has been some degree of market self-correction with respect to earthquake hazards, there is no indication that this type of action will spread throughout the lending industry or have a major impact on the housing market. Therefore it is apparent that simply providing seminars, drawing maps, or clearing away restrictive legislation will be insufficient to induce positive steps on the part of lenders and appraisers to pass on earthquake hazards information or modify lending patterns to incorporate such hazards. It is possible that professional self-regulation such as the efforts by one of the appraisal groups to incorporate strict standards including earthquake hazards in the appraisal of property may be effective, but it equally may not be adopted by appraisers, and even if it is, there is no mechanism to enforce such a standard in an industry which is highly individualistic and self-managed. In the past, new regulations or more stringent attention to mitigation practices have followed in the aftermath of major damaging earthquakes. A major earthquake in one of the large metropolitan areas of California would probably provide a renewed impetus for lender attention to earthquake hazard mitigation, especially if loan defaults or other economic losses to lender

portfolios were widespread. While this causal connection between a major damaging event and the adoption of mitigation measures is of interest, it is also important from a policy point of view to seek the adoption of mitigation measures before such an event occurs, in order to minimize tragic losses of life and property.

The implications of the empirical findings of this study are not promising for those who believe in self-correcting mechanisms or in the market providing solutions. Even in a state with widespread public awareness of seismic risk and an active campaign to involve the private sector in discussion and actions towards the initiation of mitigation behavior, one still finds the majority of home mortgage lenders unaware of the risks facing them and unwilling to change longstanding lending policies. It is likely that to induce change, economic or legal incentives will have to be introduced from outside the market system. These might include package insurance requirements from the secondary mortgage market, or outright regulation from federal agencies concerned with long-term solvency, such as the Federal Home Loan Bank Board or the Federal Reserve Board, or mandatory subsidized or unsubsidized earthquake insurance, perhaps fashioned on the model of the flood insurance program. Such suggestions, while perhaps politically unpalatable to those who believe in the sancitity of "the invisible hand" may simply be necessary to achieve commitment to earthquake hazard mitigation among home mortgage lenders.

APPENDIX I

Appraiser Questionnaire

QUESTIONNAIRE # _____

SAMPLE CATEGORY: Calif ☐ (1) Pre Sample ☐ (5)

CITY CALIF	LA	SAN FRAN	SAN DIEGO	OTHER
	☐ (1)	☐ (2)	☐ (3)	☐ (4)

NAME OF APPRAISER _____

ADDRESS _____

_____

_____

TELEPHONE _____

DATE _____

INTERVIEWED BY SM ☐ MB ☐

DATE INTERVIEWED _____

DATE LETTER MAILED _____

1. How long have you been an appraiser in this area:

   1. 0-1 year
   2. 1-3 years
   3. 3-5 years
   4. 5-10 years
   5. more than ten years

2. What percentage of your appraisals of single family homes and condo units are for lenders, homebuyers, or sellers?

	What %
lender	_____
buyer	_____
seller	_____
employee transfer	_____
dissolution	_____
other? (specify)	_____

3. When making a home appraisal, what site characteristics do you consider as the most important influences on value?

4. How do you usually incorporate the following environmental factors in your home appraisals?

a. When property is located in a floodplain

do you investigate whether this environmental factor applies to the subject property?

N Y

if so, do you note it in the appraisal report?

N Y

do you identify whether each of the comparable sales is located in a similar area?

N Y

if so, do you identify the amount of the adjustment (the impact on price of this environmental factor)

N Y

b. In doing house appraisals, do you check whether the house is in a special studies zone (fault rupture zone)

N Y

if so, do you note it in the appraisal report?

N Y

do you identify whether each of the comparable sales is located in a similar area?

N Y

if so, do you always identify the amount of the adjustment (the impact on price of this environmental factor)

N Y

c. When property is located on a surface fault trace

do you investigate whether this environmental factor applies to the subject property?

N Y

if so, do you note it in the appraisal report?

N Y

do you identify whether each of the comparable sales is located in a similar area?

N Y

if so, do you identify the amount of the adjustment (the impact on price of this environmental factor)

N Y

d. When propertry is located in a landslide area

do you investigate whether this environmental factor applies to the subject property?

N Y

if so, do you note it in the appraisal report?

N Y

do you identify whether each of the comparable sales is located in a similar area?

N Y

if so, do you identify the amount of the adjustment (the impact on price of this environmental factor)

N Y

e. When property shows evidence of damage from previous seismic activity

do you investigate whether this environmental factor applies to the subject property?

N Y

if so, do you note it in the appraisal report?

N Y

do you identify whether each of the comparable sales is located in a similar area?

N Y

if so, do you identify the amount of the adjustment (the impact on price of this environmental factor)

N Y

5. Do you usually do research on the environmental hazards mentioned in question #4 even if the client doesn't request it?

to see if the property is in a floodplain	Y	N
if property is in a special studies zone	Y	N
if property is located on a surface fault trace	Y	N
if property is located in a landslide-prone area	Y	N
if there is evidence of damage from previous seismic activity	Y	N

6. Have you ever had a client specifically ask for information concerning seismic hazard on a specific subject property?

0	1	3
NO	YES	DK

If yes, has this happened frequently (1) seldom (2)?

7. Please indicate with a 1, 2, or 3, how you think each type of client would consider the following property characteristics:

1 = Not important to the appraisal

2 = Somewhat important -- should be noted

3 = Very important, should be reflected in the appraised value

PROPERTY IS:	CLIENT: LENDER	BUYER	SELLER
LOCATED IN LANDSLIDE PRONE AREA			
LOCATED IN A FLOODPLAIN			
LOCATED ON AN EARTHQUAKE FAULT TRACE			
LOCATED IN A SPECIAL STUDIES ZONE			
SHOWING EVIDENCE OF SEISMIC OR LANDSLIDE DAMAGE			

8. What would be the price in 1982 of a fifteen-year old tract or semi-custom house with 1800 square feet, 3 bedrooms and 2 bathrooms on a standard-sized lot in an average middle-income and middle-aged neighborhood in this community?

The price of such a house would be about_____

In your experience, what range of price reduction have you encountered if:

	$	%
a. the property were in a mapped floodplain		
b. the property were in a landslide-prone area		
c. the property were in a fault rupture zone (special studies zone)		
d. there was evidence of structural damage from previous earth movement (e.g. cracked walls or foundations)		

9. What sources of information regarding earthquakes or other geologic hazards do you use?

	0 NO	1 YES	3 DK
USGS maps	___	___	___
State geologist maps	___	___	___
board of realtors maps	___	___	___
planning department maps	___	___	___
SSZ maps	___	___	___
other sources? (name)	___	___	___

10. If there were hazard maps available that could differentiate hazard potential at a block or individual property level, would you use them to

	0 NO	1 YES	3 DK
1) check the subject property location?	___	___	___
2) select comparable sales?	___	___	___
3) compute the amount of the adjustment?	___	___	___

11) Should appraisers routinely report whether a subject property is in a known hazardous area?

b. If it's not the responsibility of appraisers to volunteer this information, who do you think should do this?

Again, thank you for your time and cooperation in this study. Would you be interested in receiving a copy of the final report when it is completed?

Don't want	Want copy	
(0)	(1)	___

APPENDIX II

Specimen of Cover Letter Mailed to Chief Executive Officers of Lending Institutions

Dear :

Researchers from the University of Colorado are conducting a research project concerning the ways in which home mortgage lenders use environmental hazards information in their lending policies. As part of this project, my research assistants, Sallie Marston and Patricia Kellner, will be conducting interviews with mortgage lenders in California and Washington.

We would appreciate the opportunity to interview an executive officer in your residential real estate department. In a preliminary study of lenders in California in the summer of 1981, we found that the president or the vice-president in charge of residential real estate loans was most familiar with institutional policies and procedures with respect to environmental hazards such as earthquakes and landslides. If you should agree to participate in this study, it would be helpful if you could designate a person in your residential real estate department who might best answer questions about home mortgage lending with respect to these hazards.

Please be assured that neither your institution nor the person interviewed will be identified by name in our written report. All responses will be aggregated so that the policies and opinions of individual institutions cannot be identified. The results of this study should help to better inform lenders about earthquake hazards and should indicate lending policies that might benefit both the lending institutions and the homebuying public.

We will be phoning you shortly to set up an interview with you.

Sincerely yours,

Risa Palm
Project Director

APPENDIX III

LENDER QUESTIONNAIRE - CALIFORNIA

1. How long have you been working with this company?

   How long in this particular job?

2. What characteristics of a property do you consider to be important in the decision to grant a home mortgage loan?

3. Do you consider seismic risk when you are analyzing your portfolio of assets?

a. Such as seismic risks to your real assets (buildings)?

___ NO (0) ___ YES (1) ___ DK (3)

	NO	YES	NA
Do you have an EQ contingency plan?	(0)	(1)	(3)
Do you have EQ insurance on any of your real assets?	(0)	(1)	(3)

b. Seismic risks to commercial property?

___ NO (0) ___ YES (1) ___ DK (3)

	NO	YES	NA
In the appraisal?	(0)	(1)	(3)
In setting loan conditions (e.g., EQ ins)	(0)	(1)	(3)

c. On loans for residential real estate?

___ NO (0) ___ YES (1) ___ DK (3)

	NO	YES	NA
In the appraisal?	(0)	(1)	(3)
In setting loan conditions?	(0)	(1)	(3)

d. Do you insure your overall portfolio for losses associated with earthquakes?

___ NO (0) ___ YES (1) ___ DK (3)

If no, why not (BLIND)	(0) NOT MENTIONED	(1) MENTIONED	(3) NA
Homeowner equity covers the lender exposure	0	1	3
Portfolio is diversified in location	0	1	3
Government would aid borrowers/lenders	0	1	3
Other _____	0	1	3

4. Have you ever refused to lend or have you ever modified loan conditions based on any of the following geologic or structural conditions?

0 Never	1 Rarely	2 Sometimes	3 Frequently	5 NA	Insurance? (0)No (1)Yes (3)NA
0	1	2	3	5	1. the property is in a landslide prone area
0	1	2	3	5	2. the property is underlain by a surface fault trace?
0	1	2	3	5	3. evidence of previous damage from seismic or other geologic activity
0	1	2	3	5	4. absence of structural reinforcements to dwelling
0	1	2	3	5	5. other _____

5. Are your refusals based on a written policy?

0 Y 1 N 3 NA

(May we have a copy?)

6. If there were a buyer with particularly strong financial qualifications, would you make an exception to the policy?

0 YES 1 NO 3 NA

7. Does (name) use geologic or other scientific information regarding earthquakes or other geologic hazards as a basis for lending decisions?

0 Never 1 Rarely 2 Sometimes 3 Frequently 5 NA

(If #7 is answered with a (2) or a (3), ASK #8 and #9, otherwise go to #10)

8. At what administrative level is the hazards information considered: (BLIND)

	NO	YES	NA
1. at the time of the appraisal	0	1	3
2. when the loan officer makes his decision	0	1	3
3. when the loan is approved at a higher level	0	1	3
4. as a standing policy for the company	0	1	3
5. other level (please specify)	0	1	3

(IF #7 is answered with a (2) or (3), ASK:

9. What sources of information are used? (BLIND)

0 NO	1 YES	3 NA	
0	1	3	City or County Planning Department Maps
0	1	3	USGS Maps
0	1	3	SSZ Maps
0	1	3	Board of Realtor Maps
0	1	3	Appraisal Reports
0	1	3	Other_____

10. If there were maps available that could differentiate hazards potential at a block or individual property level, would you use such information

0	1	2	3	4
Never	Rarely	Sometimes	Frequently	NA

11. How would you regard the following special industry-wide lending policies on properties in high seismic-hazard areas?

a) Mandatory earthquake insurance

1	2	3	4
favorably	favorably w. qualific.	unfavorably w. qualific.	unfavorably

b) Mutual co-insurance (e.g. thrift and loan industry)

1	2	3	4

c) state-created insurance fund

1	2	3	4

12. Do any secondary lenders set any requirements with respect to earthquake hazards?

If yes, what kinds of requirements and which lenders?

13. If large secondary investors such as Freddie Mac were to begin to set a policy of requiring earthquake insurance on mortgages you originate, would this have any effect on your lending policies?

14. Please rate the importance of each of these characteristics in approving a loan.

How would you rate:

	Not Willing to Loan				Very Willing to Loan
woodframe construction	1	2	3	4	5
landslide area	1	2	3	4	5
seismic risk location, such as special studies zone	1	2	3	4	5
evidence of damage from previous earth movement (e.g. cracked foundation)	1	2	3	4	5

15. Consider the following estimates of property and personal losses projected by the Federal Emergency Management Agency for an 8.3 Richter scale magnitude earthquake:

Northern California

An earthquake along the Northern San Andreas Fault has a moderate likelihood of occurrence. An 8.3 event would claim $38 billion in property damage,between 3,000-11,000 dead, and between 12,000-44,000 hospitalized, depending upon the time of day that the event occurs. (1980 dollars)

Southern California

An earthquake along the Southern San Andreas fault has a high likelihood of occurrence. An 8.3 event would claim $17 billion in property damage, between 3,000-14,000 dead, and between 12,000-55,000 hospitalized, depending upon the time of day the event occurs. (1980 dollars)

0 No	1 Maybe	2 Yes	3 DK	
0	1	2	3	Local recession would occur
0	1	2	3	State-wide recession would occur
0	1	2	3	Increased mortgage defaults would occur
0	1	2	3	The combination of state and federal aid would be fully adequate to reimburse homeowners for their disaster losses
0	1	2	3	Changes in building code regulations would be made
0	1	2	3	Earthquake insurers would be unable to meet their existing liabilities

0	1	2	3	Fire insurance would become more expensive for residents
0	1	2	3	Fire insurance would become unavailable in this area
0	1	2	3	Earthquake insurance would become unavailable in this area

16. Considering the above scenario, what default rate might you expect to see in your mortgage loan portfolio?

_____%

17. Please rank the following five possible causes of mortgage default:

Unemployment of head of household ___

divorce ___

house fire ___

flooding (major) ___

major earthquake ___

18. Is the average life of a mortgage changing?

1	2	3	4
longer	shorter	no change	DK
			___

If "longer" ask:

Does this make earthquake risk more of a hazard to your portfolio?

0	1	3
NO	YES	DK
___	___	___

19. To be a successful loan officer in your institution, would it be better to make MORE loans even if some of them are risky, or to make fewer, more conservative lending decisions?

more risky (1)

fewer and safe (2)

dk (3)

other (4)

PROBE

20. At (lender name), let us say that a loan officer recommends that a loan should not be made on a given property because of seismic risk. Could this decision be overridden?

0	1	3
NO	YES	DK
___	___	___

(If yes) At what administrative level? _____

In your experience, has this ever happened?

1	2	3	4	5
frequently	sometimes	rarely	never	DK

21. Mortgage lenders require fire insurance as a condition for loans. This has forced homebuyers to invest in policies which could prevent financial losses from home fires. Do you feel that mortgage lenders COULD also reduce potential economic losses by requiring earthquake insurance on properties in designated high seismic areas.

0	1	3
NO	YES	DK

Is this a practical alternative?

0	1	3
NO	YES	DK

(explain, please)

22. If the cost of earthquake insurance could be reduced from $2/$1000 to $1/$1000, would you be more likely to require it on certain properties?

0	1	3
NO	YES	DK

23. Do you think it is the lenders responsibility to pass on information about earhtquake hazards to homebuyers?

0	1	3
NO	YES	DK

If no, then who should do this?

24. Have you or anyone else in your institution ever attended a seminar or presentation on earthquake hazards?

0	1	3
NO	YES	DK

If NO, if such a seminar were offered, do you think your loan officers would be interested in attending?

0	1	3
NO	YES	DK

25. If you were buying a house now, would you consider seismic hazard in your decision?

0	1	3
NO	YES	DK

26. Do YOU have earthquake insurance on your own home?

0	1	3
NO	YES	DK

Again, thank you for your time and cooperation in this study. Would you be interested in receiving a copy of the final report when it is completed?

Don't want	Want Copy
(0)	(1)

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