The Impact of the California Earthquake on Real Estate Firms' Stock Value

*Roger M. Shelor**
*Dwight C. Anderson**
*Mark L. Cross**

Abstract. **The purpose of this study is to examine the effect of the October 17, 1989 California earthquake on the stock value of firms involved in the real estate industry. The impact of the earthquake on real estate-related stock prices is examined. The findings indicate that the earthquake conveyed important new information to the market that was reflected in statistically significant negative stock returns among those firms operating in the San Francisco area. Real estate-related firms operating in other areas of California were generally unaffected by the earthquake.**

Introduction

The information set held by investors determines stock values which are an expression of both perceived risk and earnings expectations. All information relevant to firm value will be instantaneously reflected in stock prices in an efficient capital market. A number of studies have examined the type of information which investors consider relevant for pricing decisions. Dividend and earnings announcements, accounting procedure changes and stock splits have been considered [1, 2, 3, 6]. Recently, studies of stock reaction to merger activity among real estate investment trusts and real estate unit formation appear in the literature [4, 16].

Previous studies have addressed the impact of large losses on firm value. Sprecher and Pertl [19] and Davidson, Chandy and Cross [8] examined the impact of large losses and found these to have a negative impact. Reilly and Drzycimski [17] looked at the impact on stock values following major world events. They found that stock prices adjust immediately following the announcement.

The effect of catastrophic property damage on the value of firms involved in the real estate industry has not been analyzed. Loss potential is greater in states such as California, Texas, South Carolina, and Florida which have high concentrations of real estate that are subject to earthquake or hurricane damage.[1] The purpose of this study is to examine the impact of the October 17, 1989 San Francisco bay area earthquake on the stock value of firms involved in the California real estate industry. The occurrence and timing of the earthquake could not be anticipated and introduced new, relevant information to the marketplace instantaneously.

It is hypothesized that the California earthquake had a negative impact on the stock prices of real estate firms headquartered in the San Francisco bay area.[2] The impact on other California real estate firms should be negligible. The negative impact for San

*Department of Economics and Finance, Louisiana Tech University, Ruston, Louisiana 71272.
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Francisco firms could be attributed to the property damage, loan defaults, and a reluctance to purchase real estate in earthquake-prone areas. The potential effect of the earthquake would be of particular interest to stock investors, real estate managers, financial institutions and regulatory agencies.[3]

Location has been shown to be an important factor affecting property values [9, 11, 12, 13, 15, 18]. The earthquake impact might be different for real estate-related companies than for other firms. This is in part due to the informational content of the earthquake and the geographic concentration of real estate operations and lending. The earthquake conveyed information related to location that is important in pricing real estate. Location is of less importance for determining value in other industries. For example, the location of a manufacturing plant has little to do with the company's value. In addition, property management, development, and lending appear to be geographically concentrated. In other industries, such as auto and steel, firms do not necessarily concentrate their activities near their headquarters.

Data and Methodology

The sample is selected from those firms involved in the California real estate industry that were publicly traded in 1989 and that filed disclosure statements with the Securities and Exchange Commission (SEC).[4] These firms include building operators and lessors, agents and managers, subdividers and developers, and financial institutions (banks and savings and loans) involved in mortgage lending. Data files provided by *Compact Disclosure* are used to determine primary and secondary industry classifications, geographic areas of operation and headquarters locations. There are nineteen publicly traded firms in the real estate industry which are headquartered or have their primary operations in the San Francisco bay area. This sample consists of those firms with a primary or secondary real estate function.[5] There are forty-four companies in the sample of other California firms. These are all headquartered outside the San Francisco area and have a primary function in real estate operation, management, development, or mortgage lending.

Stock price reaction is measured using the market model. The unexpected portion of the daily return is calculated individually and collectively for both samples. The sign, magnitude, and statistical significance of the sample excess returns indicates whether there is a market response to earthquake-related information.

When security returns follow a bivariate normal distribution, the expected rate of return may be expressed in terms of the raw return using a single-factor model:

$$R_{j,t} = a_j + \beta_j(R_{m,t}) + e_{j,t} \tag{1}$$

where $R_{j,t}$ is the daily return for security j at time t and is calculated as $R_{j,t} = ln[(Price_{t+1} + Dividend)/Price_t]$; $R_{m,t}$ is the return on the S&P 500 index (a market proxy).[6] The remaining components are estimated parameters:

a_j is a random variable which represents the return of security (j) which is independent of the market.

β_j, a constant, is a measure of the change in $R_{j,t}$ given a change in $R_{m,t}$,

and

$e_{j,t}$ is the abnormal performance of the j^{th} security.

Estimated from the market performance prior to the earthquake, these parameters become estimates of the anticipated return characteristics of the event period. The estimated returns are then compared to the observed daily returns.

The expected event period return is determined by describing the characteristics of the return performance prior to the earthquake. The expected daily return for each security is computed by observing the market behavior over a 100 trading days interval. Return observations begin 100 trading days before the earthquake and continue until the day before the earthquake ($t = -100$ to -1). This regression of security and market returns is used to estimate the parameters a_j and β_j in equation 1.

Following the procedure presented by Brown and Warner [5], the research hypothesis is that there is a negative relationship between earthquake-related information and return responses. For each sample, the statistical hypothesis is that the mean excess return of each day in the event period (days 0 to 20) is equal to zero. Days 0 and 1 are of primary importance since any reaction from the earthquake should take place immediately. However, the actual extent of the damage may not become apparent until several days following the earthquake. The mean excess return for the sample is found by averaging (on an equally weighted basis) the returns for all firms in the sample.

The relationship between the earthquake and the market response is tested. San Francisco real estate-related firms are compared to other California real estate-related firms. A stock price reaction implies that new information is contained in the earthquake announcement. The strength of the market reaction is indicated by the t-test results of the statistical hypothesis that the average daily excess returns are equal to zero. This test is conducted for the twenty-day interval following the earthquake. Day zero, October 18, 1989, is the day following the earthquake.[7] The residual for each of the performance measures is calculated and the mean excess daily returns are presented.

The nature of this study is such that industry and event clustering problems are unavoidable. This issue is addressed by application of the Seemingly Unrelated Regression (SUR) Technique. We also test for risk (beta) stability between the intervals -100 to -1 and 0 to 20.

Results

The results of the nineteen San Francisco firms are reported in Exhibit 1. The large negative statistically significant mean excess return on day zero for this sample indicates that investors viewed the earthquake as a signal of unfavorable financial conditions for the real estate industry in the San Francisco bay area. The market response to the earthquake among other California firms is also presented in Exhibit 1. Mean excess returns for the sample of forty-four other California firms are small and without statistical significance. The returns are consistent with those that would be observed for an event that had no impact on market valuation. This result was expected.

The beta stability results are shown in Exhibit 2. The t-test results of the difference between betas is not significant. The Seemingly Unrelated Regression (SUR) technique is also employed to address the calendar clustering that is inherent in this study. Parameter estimates and results using the SUR technique are not substantially different from those reported here.[8]

Exhibit 1
Market Response Measures for San Francisco and Other California Real Estate Firms

	Bay Area Firms ($n=19$)			Other California Firms ($n=44$)		
Event Date	Excess Returns	Cumulative Excess Returns	t-value	Excess Returns	Cumulative Excess Returns	t-value
0	−1,6540	−1.6540	−2.93**	−0.3775	−0.3775	−1.03
1	0.7031	−0.9509	1.22	0.2924	−0.0851	0.74
2	0.7090	−0.2419	1.03	−0.3178	−0.4029	−0.81
3	0.1577	−0.0842	0.26	−0.6183	−1.0212	−1.56
4	−0.6630	−0.7472	−0.99	−0.3161	−1.3373	−0.90
5	−0.3236	−1.0708	−0.76	−0.7820	−2.1193	−3.07**
6	−0.4565	−1.5273	−0.65	0.3436	−1.7757	0.78
7	−0.1109	−1.6382	−0.16	−0.6220	−2.3977	−1.53
8	−0.1327	−1.7709	−0.18	0.2309	−2.1668	0.59
9	−0.2143	−1.9852	−0.32	−0.0158	−2.1826	−0.04
10	0.2424	−1.7428	0.37	−0.6367	−2.8193	−1.89
11	0.3124	−1.4304	0.48	−0.0335	−2.8528	−0.06
12	−0.6358	−2.0662	−0.95	−0.3900	−3.2428	−1.18
13	−0.5864	−2.6526	−0.69	−1.0489	−4.2917	−2.31*
14	−0.2361	−2.8887	−0.36	−0.0276	−4.3193	−0.06
15	0.9553	−1.9334	1.10	−0.2188	−4.5381	−0.41
16	−0.7319	−2.6653	−1.29	−0.1025	−4.6406	−0.19
17	−0.5833	−3.2486	−1.49	−0.2316	−4.8722	−0.37
18	−1.3503	−4.5989	−2.75*	0.0500	−4.8221	0.09
19	1.0834	−3.5155	1.70	0.8830	−3.9392	1.39
20	−1.2216	−4.7371	−2.02*	0.6968	−3.2424	0.84

**Significant at the 0.01 level
*Significant at the 0.05 level

Exhibit 2
Beta Stability Results

	Beta: days −100 to −1	*Beta:* days 0 to 20	t-value
San Francisco Firms	0.37	0.41	0.721
Other California Firms	0.72	0.74	0.846

*Significant at 0.05 level

Conclusions

The results indicate that the earthquake conveyed important new information to the market that was reflected in reduced stock values for San Francisco bay area firms involved in real estate management, operation, development, and mortgage lending. This implies that the earthquake conveyed information about location, an important factor in real estate valuation and financing. The riskiness of property ownership and financing in earthquake-prone areas is emphasized by this disaster. Real estate investors should consider the risk of a catastrophic loss (such as in an earthquake or hurricane) and the negative impact on values. Mortgage lenders and financial institution regulators should consider these results in determining the desirability and collateral value of real estate in these areas. Lenders and regulators may find it necessary to require earthquake insurance when real estate is used as collateral. Lenders should recognize the effects described in this paper when constructing their loan portfolios. Undue concentration of loans in earthquake-prone areas may be undesirable from the lender and regulatory viewpoint. Investors should include a risk premium in their required rates of return for real estate firms heavily concentrated in earthquake-prone areas.

The nature of the loan application and mortgage lending process usually requires physical contact between borrowers and lenders. However, the possibility of catastrophic loss might restrict the ability of lenders to sell San Francisco area loans in the secondary mortgage market. The secondary market might require a risk premium on bay area mortgages or require earthquake insurance on these properties. The net effect will be to reduce the return that initial lenders obtain when selling mortgages.

The stability of beta over the periods -100 to -1, and 0 to 20 implies that the significant results are not due to a risk shift (measured by beta) among these companies. The results using the SUR approach are not substantially different from those using Ordinary Least Squares (OLS). This finding is consistent with those reported by Malatesta [14] and suggest that the OLS technique is sufficiently robust to handle the industry and event clustering problem without further adjustment.

The sample size used in this paper might have some impact on the results. The conclusions should be viewed with this in mind. However, similar industry-specific studies have used sample sizes equal to or smaller than that used in this study [7, 10].

Notes

[1]Hurricane Hugo caused approximately $5 billion in losses along the East Coast. The October 17, 1989 California earthquake caused approximately $2 billion of damages.

[2]"The Bay Area Earthquake," *Wall Street Journal*, October 19, 1989, p. A14:1.

[3]For those financial institutions with real estate loans in the San Francisco area, loan defaults could be high, unless the borrower was required to carry adequate earthquake insurance. A relatively small percent of residences in the San Francisco area carried earthquake insurance.

[4]The issue of thin trading was addressed by eliminating those firms which had insufficient trading activity to calculate reliable estimates of beta. This screen did not significantly reduce the sample size.

[5]It is also assumed that these real estate-related firms undertake a substantial amount of their business in the bay area. Using *Compact Disclosure*, we found that most firms indicated a tendency to lend in the area they are headquartered.

[6]$R_{j,t}$ is a continuously compounded return. The use of log transformed returns improves the normality of the return distribution and eliminates negative values.
[7]The quake hit California during the afternoon of October 17, 1989, which was after the East Coast markets had closed.
[8]The SUR results are available upon request by the reader.

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