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The Impact of Public Perception of Earthquake Risk on Istanbul's Housing Market

Zeynep Önder,* Vedia Dökmeci** and Berna Keskin***

Abstract

This paper examines the impact of public perception of earthquake risk on Istanbul's housing market by investigating the spatial distribution of the average house values and the changes in average house prices in Istanbul between 1995 and 2000. Soil type and distance to the fault lines in the Sea of Marmara are used as proxies for public perception of earthquake risk. The results of regression analysis show that distance from fault lines is an important factor in explaining house values and its impact on house values increased after the 1999 Kocaeli earthquake. Furthermore, there is a quadratic relationship between soil type and house values. However, none of the measures of earthquake risk significantly affect the change in house values. These findings suggest that public perception of earthquake risk enhanced and the public information about earthquake hazard had significant impact on house values.

Introduction

The purpose of this paper is to examine the impact of the public perception of earthquake risk on house prices in Istanbul between 1995 and 2000. The introduction of natural hazards information into a market will potentially alter individuals' perception of risk as that risk relates to investment activities (Bernknopf, Brookshire and Thayer, 1990). After the Kocaeli earthquake in 1999, the public became more conscious of dangers of a catastrophic earthquake such as injury and death, damage to property and disaster relief costs. Public perception of earthquake risk has been developed by continual media attention to warnings from geologists about soil types and the distance from the fault lines in the Sea of Marmara. It is known that certain types of soil enhance ground motion and increase earthquake damage. Also, fault lines are described with a probability distribution of possible earthquake magnitudes. It is expected that these warnings have caused temporary shocks to the market and the community proportional to the level of the risk announced. In fact, although a probabilistic seismic hazard map has not been yet prepared, demand for housing in a few neighborhoods has increased and thus housing prices have too, while in others, it has fallen according to public perceptions of geologists' findings.

Although there have been several studies to determine environmental impacts on housing prices, the few studies with respect to earthquake risks have been mostly in

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the United States (Willis and Asgary, 1997). Those studies use different methods to determine the effect of earthquake risks on the housing market, and have produced somewhat different results. Brookshire and Schulze (1980) developed a contingent valuation method to determine the effects of earthquake risk on the housing market in California. According to their results, only 26% of respondents were willing to pay more for a stronger construction. Palm (1987, 1990) did a group of studies on housing markets and earthquake risks. She investigated the effectiveness of mandated disclosure legislation in California. According to this legislation, real estate agents should inform all home buyers about the seismic risk related to the location of a house. Her study showed that people paid little attention to earthquake hazards. Palm (1990) also conducted a survey of real estate appraisers to evaluate their methods of dealing with earthquake hazards. The results of her study showed that the legislation did not significantly affect the housing market. Most of the appraisers did not give any higher price on an identical property in a lower risk area. They indicated that clients had only rarely asked about seismic hazards, and few purchasers checked for evidence of previous damage from earthquakes or location on a surface-fault trace (Willis and Asgary (1997). Bernknopf, Brookshire and Thayer (1990) studied the effects of earthquake hazard risks on investment behavior and housing prices in the resort community of Mammoth Lakes in California. According to their results, the hazard notices affected investment, but not recreational use. However, a perceived loss in the market value of homes was documented. Another study by Murdoch, Singh and Thayer (1993) showed the effect of the Loma Prieta earthquake on the housing prices. They observed a 2% reduction in house prices. Studies by Brookshire, Thayer, Tschirhat and Schultze (1985) and MacDonald, Murdoch and White (1987) illustrated that risk information had an influence on the housing markets. A comprehensive review of the previous research by Willis and Asgary (1997) reveals that an earthquake can influence the short-term housing market. Also, they illustrate a lack of information on the effects of earthquake risk on housing markets in developing countries.

Although there are some studies on the impact of earthquake risk on housing values in developed countries, there is only one excellent study by Willis and Asgary (1997) in developing countries, where earthquake hazards are often more catastrophic than in developed countries due to their substandard housing and less efficient disaster management programs (Tuker, Trumbull and Wyss (1994). Using a contingent valuation method, a survey of real estate agents was conducted by Willis and Asgary to find the effects of earthquake risk reduction measures on the housing market in Tehran, Iran, which is located in a high-earthquake-risk zone. The results showed that there was a significant price difference between earthquake-resistant houses across all districts in the city. This difference might further increase with the increased information about earthquake risk. The authors measured the impacts of construction policies rather than land use policy regulations, holding location constant. In contrast to previous research, this current study estimates real difference among houses in terms of resistance to earthquakes of different magnitudes.

This paper investigates the relationships between housing unit prices and earthquake risk measured by soil types and distance from the fault lines in the Sea of Marmara in Istanbul, Turkey. The organization of the paper is as follows. Background

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information about the general structural characteristics of Istanbul and the changes of house prices in recent years is presented, followed by a discussion of a regression analysis of changes in residential prices with respect to soil types and distances from the fault lines in the Sea of Marmara. Finally, concluding comments are presented.

Background

Istanbul, with a population of 10 million, is the largest city in Turkey. Major qualitative differences exist in the economic, social and environmental conditions that characterize Istanbul. It is the most important financial, cultural and educational area of the country. At the same time, it is a city world-famous for its natural beauty and historical monuments, reflecting its role as the capital of three separate empires. It enjoys shorelines on the Black Sea, the Sea of Marmara and the Bosphorus Strait, which attract people throughout the country and the demand for and thus the price of housing increase in Istanbul. Moreover, the rapid growth of the city since the 1950s, due to rural migration, has affected the quality of life in various sections of the city. While some of the modern districts have become comparatively more attractive, the historic districts have lost wealthy population due to the deterioration of their neighborhoods and the settlement of low income migrants. Meanwhile, alternating periods of rampant inflation have spurred the demand for real estate, one of the few inflation-resistant forms of investment—just as it is in many countries, developed as well as developing. Furthermore, the construction of bridges on the Bosphorus and the Golden Horn have changed the accessibility of various areas measurably, and have thus caused a transformation in the land-use pattern from mono-centric to multi-centric development. Moreover, the construction of the modern housing projects on the periphery has created not only new opportunities for housing markets but also a trend toward living in modern urban settlements surrounded by green areas with suburban amenities. Since officially sanctioned housing, services and infrastructure have not kept pace with the rapid population increase, unauthorized settlements on the periphery have resulted. These changes have created locational advantages or disadvantages, which are reflected in the real estate market and intra-urban migration, which in turn have affected demand for housing and housing prices (Dokmeci et al. 1996; and Dokmeci and Berkoz, 2000).

Istanbul's urban neighborhoods have considerably differed economically and culturally from one another throughout history. These differences have come not only from being the capital of three empires but also from its multi-cultural structure and international characteristics. Moreover, there is substantial evidence that these differences have become greater in recent years.

The transformation of Istanbul from a mono-centric into a multi-centric city produced three peak housing price areas (Dokmeci and Berkoz (1994). One of these, located between the new Central Business District (CBD) (Sisli-Mecidiyekoy) and the Bosphorus, has the highest residential prices. This area has the greatest accessibility to both high-paid jobs and scenic views of the Bosphorus; it also has equal accessibility to different parts of the city via the peripheral highways. This development axis has two prestigious universities and a large shopping mall (250,000 m^2).[1]

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As a result, the area attracts middle- and upper-income people, producing a prestigious area with high residential prices.

Bakirkoy, the district with the second highest residential prices in its neighborhoods such as Yesilkoy, Yesilyurt and Florya, is located on the Sea of Marmara, near the airport, a large shopping mall and a marina with luxurious hotel and office complexes. This is a traditional high-status suburban area with easy access to peripheral highways and to the CBD. It also enjoys seashore amenities. Moreover, housing demand from high-paid airline personnel who prefer to live close to the airport increases residential prices in this area.

The district with the third highest residential prices is Kadikoy located on the Asian side of Istanbul. This area with its modern housing and exclusive pedestrian shopping street (10 km long), enjoys amenities from being on the cost. This is a traditional high-status area continuously attracting many well-to-do families from other districts (Dokmeci et al., 1996).

Data and Empirical Model

The impact of public perception of earthquake risk on housing values is investigated for the homogeneous neighborhoods of Istanbul for the years 1995 and 2000. In the analysis, homogeneous neighborhoods are used as a unit of observation instead of districts because neighborhoods located in the same district might show different characteristics. For example, Atakoy and Bakirkoy are located in Bakirkoy district and although the average size of the houses in these neighborhoods was similar in 2000, the average house value per square meter was $1,209 (819 million TL) and $431 (292 million TL) in these neighborhoods respectively (see the Appendix). A homogeneous neighborhood is defined as a spatially contiguous region of the city with sufficient population to be considered as a neighborhood in which all resident households and housing units have similar characteristics. These characteristics include an entire array of housing stock/service and site characteristics, resident household characteristics, neighborhood amenities and accessibility characteristics rather than just the usual income characteristics. Factors operating on the demand or supply side of the market (or both), create tendencies for spatial concentration of like-type households, house units, neighborhood amenities or accessibility. Differences in demand or supply conditions can arise from the following sources: different preferences of households, different incomes and wealth among households, and different cost functions of housing suppliers. These differences in turn can result in a differentiated price structure across neighborhoods and hence differentiated locational choice (Vandell, 1995).

House values are obtained from the advertisements in the newspapers for the month of October in 1995 and 2000. This month was especially chosen since there are usually a lot of housing transactions. There were 5,627 and 1,525 cases gathered about price, size and location of houses from the advertisements in 1995 and 2000 respectively. Average house price and average house size for each neighborhood is calculated from these data. Since the average size of housing units show variation among

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neighborhoods, the house value per square meter is used in the estimations. These values are reported in the Appendix and shown in Exhibit 1.

Twenty-eight neighborhoods on the Asian side of the city and 35 neighborhoods from the European side are taken into consideration. The mean values were higher on the European side than the Asian side in both years. However, the average house size was larger on the Asian side. There were some variations in values among neighborhoods (Exhibit 2). For example, the mean house value per square meter was 39 million Turkish Liras (TL) ($730) in 1995, changing between $151 in Gaziosmanpasa and $2,692 in Bebek. The average house values per square meter increased in 2000 to $875. The lowest value, $195, was observed in Avcilar, which is considered to be affected most from the earthquake. Even in 2000, Bebek had the most expensive houses with the average value of $3,958 per square meter.

In the analysis of the change in house values over time with the earthquake, it is assumed that prices in all neighborhoods increase at a rate equal to the increase in the cost of construction index (CCI)[2] since there are more years before the earthquake than after. Hence, the 1995 values are deflated at the cost of construction. These deflated values show the average house value in 2000 if house prices increased at a rate equal to the increases in CCI since 1995. Then, the percentage change between the actual 2000 averages and the deflated 1995 values is used in order to examine the impact of earthquake risk on the change in house values.[3]

While average unit house price increased 38% in all neighborhoods, there are some variations on the change in house prices in both sides of the city. The range of house price changes varies on the Asian side from −24% in Goztepe to 287% in Cengelkoy because Goztepe is nearer to the fault line than Cengelkoy, which also enjoys the amenities of the Bosphorus. There was only a 32% increase on the Usküdar Coast, which enjoys the most beautiful view of the Topkapi Palace, and 70% increase in Atasehir, which is a relatively new neighborhood constructed with advanced techniques by well-known construction companies, wining the Habitat II reward in 1996. It is also far from the fault line. In contrast, there was an 11% decrease in a historical neighborhood (Moda), which is also nearer the fault line. On the other hand, in the European side of the city, the range of house price change varies from a 230% increase in Macka, which is claimed by geologists to have very sound soil to a 42% decrease in Ok Meydani. The reasons can be the lack of infrastructure and investment in Ok Meydani while Macka has a more resistant soil type. Moreover, a 9% increase is observed in Mecidiyekoy, which is in the new CBD. Meanwhile, it is known that a 12% decrease in the average unit house prices in Yesilkoy and Yesilyurt and a 16% decline in Avcilar are due to low quality soil and short distance to the fault line located in the Sea of Marmara. As a very heterogeneous total, the average house price per square meter increased 28.2% on the Asian side and 45.9% on the European side of the city.

Although Istanbul has had some major earthquakes during its history, none of them have been destructive enough to destroy major 500 or 1500 years old historical buildings according to some international geologists such as McKenzie. Therefore, if

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Exhibit 1
Unit House Prices in Istanbul

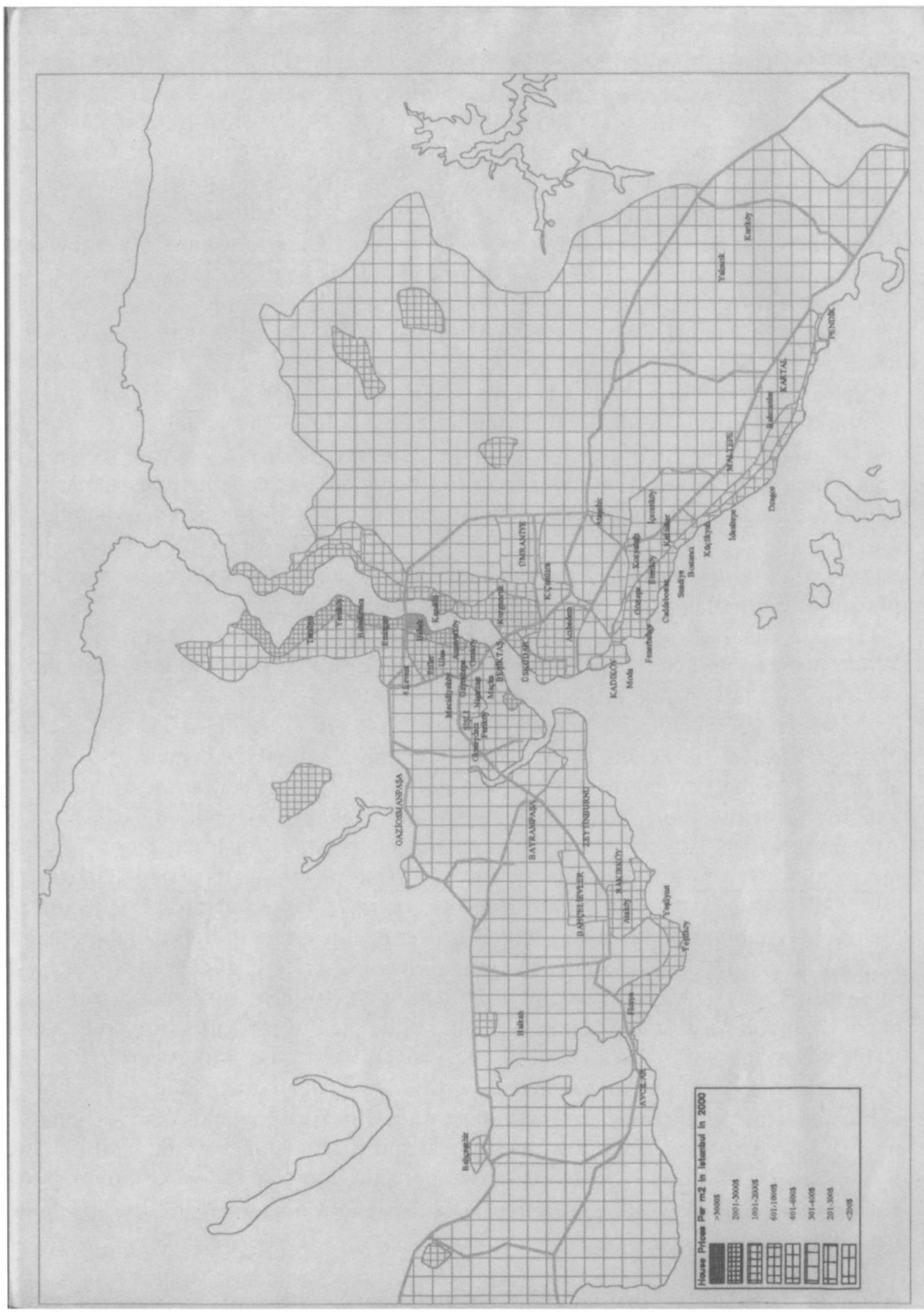

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Exhibit 2
Descriptive Statistics of Variables

Variable	Mean	Std. Dev.	Min.	Max.
Housing Characteristics				
House Values (in million TL)				
1995	6,266	5,607	680	25,861
2000	134,052	171,185	14,356	776,866
Per square meter (in million TL)				
1995	39	28	8	135
2000	596	521	133	2,694
House Values (in $US)				
1995	125,208	112,033	13,587	516,729
2000	196,897	251,951	21,121	1,146,875
Per square meter (in $US)				
1995	783	564	151	2,692
2000	875	766	195	3,958
Growth rate of House Values per square meter (%)				
Deflated with CCI	38.19	63.41	−42.31	287.46
in $US	14.18	52.19	−52.69	218.41
Size of Housing Units (square meter)				
1995	138.76	31.97	64.33	235.00
2000	176.53	75.88	71.92	430.00
Earthquake Risk Measures				
Soil Type	12.09	3.75	3.00	16.00
Distance from Fault Lines	16.09	6.05	5.10	31.70
Other Neighborhood Characteristics				
Age	11.80	8.18	0.00	35.00
Asia	0.44	0.50	0.00	1.00
Distance from CBD	15.48	9.64	4.00	39.00
Commercial (Dummy Variable)	0.86	0.35	0.00	1.00

Note: $N = 64$.

there is one in the future, it will probably not be any more destructive. However, it is worthwhile to investigate seismic impact by looking at housing prices and their changes in certain neighborhoods, and the recommendations of geologists.

In this study, earthquake risk is proxied by two variables: the soil type of the neighborhood and the distance from the fault lines located in the Sea of Marmara. The distance from the fault lines is calculated using the map prepared by the Istanbul Metropolitan Municipality. Although people generally know the type of soil where their houses are located, the distance from the fault lines became public information after the 1999 Kocaeli earthquake with the expectation of another major earthquake in the region in the next forty years. The distance from the fault lines varies from 5.10 kilometers (Yesilyurt and Yesilkoy) to 31.70 kilometers (Maslak). Soil type is graded from 1 to 16 according to geological data dealing with earthquake risk (16 being the safest, and one being the least). Soil type is also obtained from the city

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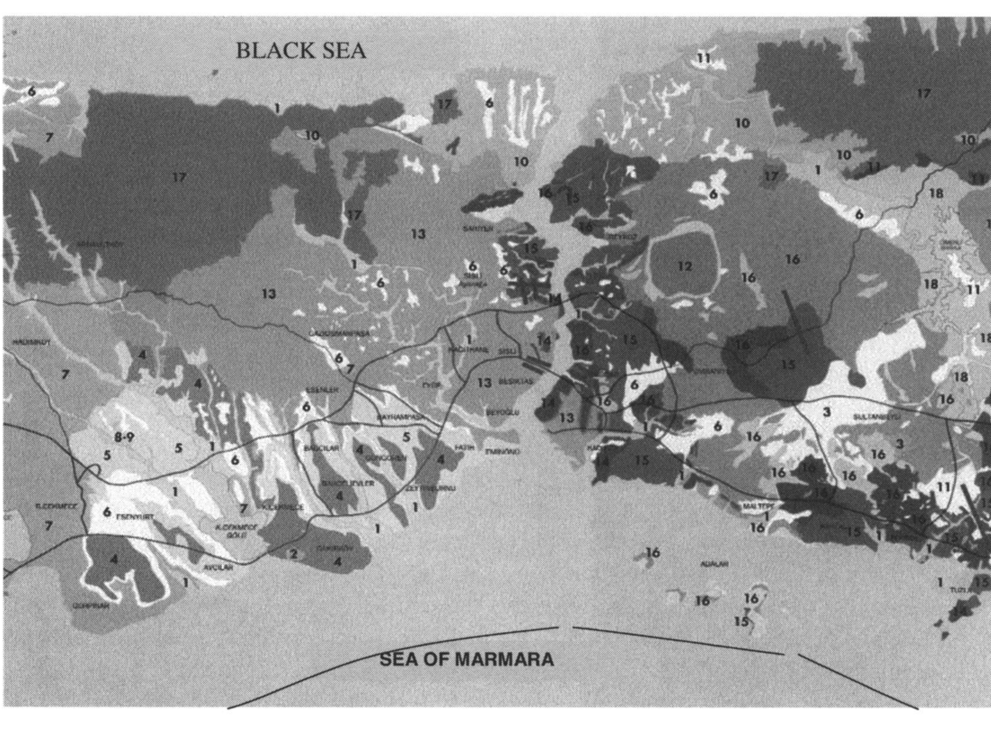
government. Exhibit 3 depicts the fault lines and soil types of different neighborhoods in Istanbul. The lowest quality soil is observed in Avcilar; the soil in Cengelkoy is one of the safest, and the area had the highest increase in unit house values in 2000. The other safest neighborhoods in terms of soil type are Dragos, Pendik and Kandilli.

The relationship between the unit house prices and earthquake risk measured by soil types and earthquake risk is investigated by regression analysis. While some studies have used hedonic price method to analyze the impact of earthquake risk on house prices in developed countries (Brookshire et al., 1985; and Bernknopf, Brookshire and Thayer 1990), the application of hedonic price method in many developing countries is difficult because of a lack of sufficient data (Willis and Asgary, 1997). In fact, there is no database of house price transactions in Istanbul that can be used to determine the relationships between house characteristics, socioeconomic neighborhood effects, location, accessibility to facilities and earthquake risk and house prices. Hence, house values in homogeneous neighborhoods are estimated by controlling very few neighborhood characteristics.

In order to examine how house values were affected after the major earthquake, Model 1 is estimated for the 1995 and 2000 separately at the neighborhood level:

Exhibit 3
Soil Types and Fault Lines in Istanbul



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$$Value_i = \beta_0 + \beta_1 Distance_i + \beta_2 Soil_i + \beta_3 Asia_i + \beta_4 Age_i + \beta_5 DistanceCBD_i + \varepsilon_i, \quad (1)$$

where $Value_i$ is the logarithm of the average house value per square meter in neighborhood i in years 1995 and 2000. $Distance_i$ represents the distance of the neighborhood to the fault lines expressed in kilometers. $Soil_i$ shows the type of soil and it is an ordinal number taking a value between 3 and 16. As this variable increases, the quality of soil for constructions increases. The impact of these variables on the house values is expected to increase in 2000, after the major earthquake. $Asia_i$, Age_i and $DistanceCBD_i$ are control variables that affect house values in neighborhoods. Age_i is the average age of houses in each neighborhood, obtained from Egdemir (2001). As the average age of housing units in neighborhood increases, it is expected that the value of houses will decline since the old building construction is less earthquake resistant. $DistanceCBD_i$ represents the distance to the major CBD in Istanbul, Besiktas. Accessibility to the CBD may be considered as a positive amenity and those neighborhoods that are closer to the CBD are expected to have higher house values. Since most of the residents live in the Asian side of the city and work in the European, a dummy variable, $Asia_i$, is included to control for this effect on house values. As reported in Exhibit 2, 44% of neighborhoods are located in the Asian side of the city. The average age of housing units was 11.80 years. The distance to the CBD changes between 4 and 39 kilometers.

The effect of earthquake risk on the change in house values is estimated using Model 2:

$$ChangeinValue_i = \beta_0 + \beta_1 Distance_i + \beta_2 Soil_i + \beta_3 Asia_i + \beta_4 Age_i + \beta_5 DistanceCBD_i + \varepsilon_i, \quad (2)$$

where $ChangeinValue_i$ represents the percentage change in unit house value from deflated 1995 prices and the 2000 prices.

Empirical Results

It is expected that there will be a higher impact of earthquake risk measures on house values after the 1999 earthquake, assuming that consumers have enough information on earthquake risks where they live. Exhibits 4 and 5 present the results of the regression analysis for years 1995 and 2000. It is found that as distance from the fault lines increases, the value of houses increases. Furthermore, as expected, the impact of this earthquake risk measure increases after the earthquake. However, no evidence of significant impact of soil type on house values was found. However, it is possible that there is non-linear relationship between soil type and house value.[4] Another model that includes square of soil type is also estimated in order to find out any non-linear relationship. These findings indicate that house values decline at low levels of soil type and as the quality of soil increases, house values increase significantly controlling

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Exhibit 4
Regression Analysis of House Values per Square Meter in 1995 and 2000

	Model I		Model II	
	1995	2000	1995	2000
Intercept	16.153***	18.830***	17.689***	20.512***
	(37.70)	(44.81)	(24.42)	(29.28)
Measures of Earthquake Risk				
Soil Type	−0.006	−0.005	−0.375**	−0.409***
	(−0.20)	(−0.17)	(−2.56)	(−2.89)
Soil Type^2			0.019**	0.021***
			(2.57)	(2.91)
Distance from Fault Lines	0.049**	0.070***	0.052***	0.073**
	(2.63)	(3.80)	(2.89)	(4.18)
Other Neighborhood Characteristics				
Age	0.021*	0.010	0.020*	0.008
	(1.80)	(0.83)	(1.75)	(0.73)
Asia	−0.167	0.087	−0.025	0.243
	(−0.49)	(0.26)	(−0.07)	(0.75)
Distance from CBD	0.013	−0.008	0.002	−0.021
	(0.69)	(−0.46)	(0.10)	(−1.16)
Adjusted R^2	0.1512	0.3178	0.2259	0.3955
F-Statistic	3.24	6.87	4.06	7.87
p-value	0.0119	<0.0001	0.0018	<0.0001
Durbin-Watson statistic	2.028	1.955	1.991	2.073

Notes: t-Statistics are presented in parentheses. $N = 64$.
*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

Exhibit 5
Test of Equality of Measures of Earthquake Risk in 1995 and 2000

	F-Statistic	p-value	F-Statistic	p-value
Soil Type	0.00	0.9506	0.15	0.7026
Soil Type^2			0.16	0.6877
Distance from Fault Lines	3.69	0.0597	3.71	0.0592

Notes:
*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

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for the distance from the fault lines and age of housing units, distance from CBD and location of the neighborhood. Moreover, explanatory power of the model is higher for the year 2000 than for 1995. Even in the second model, the impact of distance from fault lines on house values increases significantly in 2000 because people became more conscious after earthquake.

Exhibit 6 reposts the results of the regression analysis of the changes in house values. The measures of earthquake risk seem to explain 9.28% of the variation in the percentage change in house values. However, although distance from fault lines is a significant factor affecting the growth in house values, its effect disappears when other neighborhood characteristics are controlled for. None of the earthquake risk measures significantly affects the change in house values before and after the earthquake.

Conclusion

This study investigates the relationship between the changes in average unit house prices between 1995 and 2000 and soil types and distances from the fault lines in Istanbul. Regression analysis is used for the investigation. After the Kocaeli earthquake in 1999, people became more conscious of earthquake risk. Geologists' warnings have heightened public awareness and promoted hazard mitigation in case

Exhibit 6
Change in House Values: 1995–2000

	Restricted Models		Full Model
Intercept	−0.214	1.177***	0.637
	(−0.80)	(4.50)	(1.45)
Measures of Earthquake Risk			
Soil Type	−0.004		−0.001
	(−0.17)		(−0.04)
Distance from Fault Line	0.037		0.023
	(2.50)		(1.24)
Neighborhood Characteristics			
Age		−0.025**	−0.022**
		(−2.39)	(−2.03)
Asia		0.800**	0.669
		(2.64)	(2.03)
Distance from CBD		−0.059***	−0.045
		(−3.42)	(−2.35)
Adjusted R^2	0.0928	0.1417	0.1481
F-Statistic	3.97	4.19	3.02
p-value	0.0245	0.0096	0.0181
Durbin-Watson statistic	1.9300	2.004	2.0400

Notes: $N = 57$. Test of Hypothesis $\beta_{Soil\ Type} = \beta_{Distance\ from\ fault\ lines} = 0$.
F-test = 0.1091, which is not significant.

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of an earthquake. Although there are many factors that affect housing prices in Istanbul due to its rapid growth and thus dynamic structure, none of the earthquake risk measures significantly affects the change in house values before and after the Kocaeli earthquake. So, the impact of geologists' warnings about soil types was limited to only a few high-income locations, thus not thus influencing the regression results. Since municipal governments of districts have required local soil inspection reports for construction permits, this measure will help to obtain more scientific information about soil types and thus a more realist evaluation of their impact on housing prices in the future.

Previous studies suggest that an earthquake can influence the housing market in the shorter term (Willis and Asgary, 1997). Also in Istanbul, in 2000, one year after the Kocaeli earthquake 1999, the amount of people who desire to investigate their buildings' construction systems with respect to earthquake resistance was nil. Therefore, market activity seems to have returned to pre-warning levels once the announcements stopped and the perceived risk to individuals subsided (Bernknopf, Brookshire and Thayer, 1990). This research can be extended to include a hedonic price method and other metropolitan areas in Turkey in order to drive more general results.

Appendix

Characteristics of Housing Units in Neighborhoods: 1995 and 2000

	1995 Deflated at CCI			2000		
Neighborhood	Mean	Std. Dev. of Value	Size	Mean	Std. Dev. of Value	Size
Panel A: Neighborhoods in the European Side						
Akatlar	543	223	121	942	564	141
Arnavutköy	1,173	584	150	889	677	253
Ataköy	874	217	64	819	158	114
Avcilar	158	55	127	133	26	140
Bahcelievler	282	140	125	504	122	175
Bakirköy	280	104	121	292	12	120
Balmumcu	401	49	119	689	243	201
Baltalimani	1,018	312	130	2,287	1,550	354
Bebek	1,515	763	187	2,694	1,206	254
Besiktaş	268	148	109	359	96	99
Cihangir	221	130	97			
Emirgan	692	427	164	946	703	329
Etiler	629	335	143	650	191	169
Feriköy	268	43	125	222	58	87
Findikzade	176	67	83			
Florya	645	299	195	587	109	271
Gayrettepe	415	318	125	489	107	147
Gaziosmanpaşa				228	8	134
Halkali	246	97	96	295	155	72
Kurtuluş	234	62	119	283	138	112
1. Levent	597	563	152	923	364	217

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Appendix (continued)

Characteristics of Housing Units in Neighborhoods: 1995 and 2000

	1995 Deflated at CCI			2000		
Neighborhood	Mean	Std. Dev. of Value	Size	Mean	Std. Dev. of Value	Size
Panel A: Neighborhoods in the European Side (continued)						
4. Levent	460	176	146	551	96	123
Maçka	482	216	144	1,591	317	250
Maşlak	295	205	155			
Mecidiyeköy	260	71	120	284	129	117
Nişantaşi, Topağaci	326	101	134	671	141	175
Ok Meydani	235	65	90	136	45	125
Ortaköy	519	236	192			
Şişli	280	132	139	550	59	100
Tarabya	799	267	199	604	181	194
Teşvikiye	323	126	169	496	143	134
Ulus	765	339	181	1,030	212	222
Yeniköy	890	496	170	1,494	1,210	194
Yesilköy, Yeşilyurt	734	206	160	648	130	265
Zeytinburnu	123	27	125	173	121	82
Panel B: Neighborhoods in the Asian Side						
Acibadem, Koşuyolu	305	124	144	427	209	141
Ataşehir	382	116	102	649	171	113
Bostanci	292	126	144	265	78	138
Caddeboştan, Çiftehavuzlar	486	225	157	521	213	166
Çengelköy	135	30	141	524	409	242
Dragos	601	241	215	583	386	248
Erenköy	360	143	151	370	156	151
Fenerbahçe, Kalamiş, Dalyan	504	226	154	448	225	153
Göztepe	356	262	148	270	97	136
Içerenkoy	182	22	126	202	46	133
İdealtepe	218	79	151	202	77	138
Kadiköy	201	84	108	198	33	90
Kandilli	1,082	127	235	1,957	605	400
Kanlica	1,377	782	140	1,761	792	430
Kartal	165	60	133	160	58	134
Kazaşker, Tüccarbaşi	265	67	130	233	54	137
Kozyataği	272	71	137	284	93	134
Kurtköy, Yakacik, Tuzla	88	5	100	140	46	134
Kuzguncuk	967	755	164	948	207	294
K. Çamlica	305	61	135	814	624	260
Maltepe	207	96	148	170	39	142
Moda	414	221	130	367	223	120
Pendik	173	61	135	191	33	171
Şenesenevler	252	68	133	281	54	152
Suadiye, Şaşkinbakkal	407	218	156	446	217	155
Ümraniye	120	31	111	216	104	128
Üsküdar	192	60	109	176	42	126
Üsküdar-Coast	584	348	180	771	446	199

Notes: Mean and standard deviation of values (TL in million/m^2) and mean size (m^2).

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Endnotes

1. Muth (1969) shows that these types of developments contribute to high residential prices.
2. The State Institute of Statistics provides the CCI for the whole country and for the four regions in Turkey. In the estimations, the CCI for the second region is used. Istanbul is included in this region.
3. The regression results did not change when house value appreciation rates in TL or US dollars are used. However, house values expressed in US dollars will underestimate house value appreciation rate because the average annual depreciation of TL against the US dollar was 62% for the period between 1995 and 2000. Furthermore, the average annual inflation rate was 65% for the same period. Therefore, the change in house values in terms of TL will result in underestimation of real house appreciation rate.
4. We would like to thank to the anonymous referee for pointing out this type of relationship.

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