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EQUITY AND TIME TO SALE IN THE REAL ESTATE MARKET

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ABSTRACT

Recent research has proposed a pro-cyclical link between sales volume and prices in the real estate market through changes in the equity of existing homeowners. This article uses data from the Boston condominium market to show that owners with high loan-to-value ratios take longer to sell their properties than owners with low loan-to-value ratios. Properties with high loan-to-value ratios are listed at higher asking prices; when sold, they receive higher prices than units with less debt. Together, these results are consistent with a search model in which owners "constrained" by large amounts of debt set a higher reservation price than "unconstrained" owners, accepting a lower probability of sale in exchange for a higher final sales price.

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Equity and Time to Sale in the Real Estate Market

I. Introduction

One of the distinctive and puzzling features of the housing market is the dramatic variation in real prices and sales volume over time. In the United States, for example, total sales of existing homes increased from 1.6 million in 1970 to 3.8 million in 1979, and then fell 50 percent by 1982 (National Association of Realtors 1993). Over that same time period, real prices rose 41 percent, and then declined by almost one-seventh. Regional changes are even more dramatic.[1] The implications of such fluctuations in the real estate market are significant given that the portfolio of most households is heavily concentrated in real estate. Owner-occupied real estate comprises over one-third of total U.S. net worth, and the median homeowner has 20 times as much housing equity as liquid assets.[2]

Some have argued that this positive price-volume correlation in real estate is due to sellers who do not accept market conditions when prices fall, refusing to sell their house for a nominal loss or below some arbitrary value that is unrelated to the current market price.[3] Others have suggested that

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[1]In Massachusetts, for example, real prices rose 130 percent between 1982 and 1987, while total sales of existing homes increased from 42,500 to over 100,000. In the subsequent bust, real prices fell by one-third and sales fell below 60,000. (National Association of Realtors 1993; Case, Shiller and Weiss, Inc.)

[2]Sources: 1994 Economic Report of the President; and authors' calculations from the 1991 Survey of Income and Program Participation.

[3]Case and Shiller's 1988 survey of recent home buyers found that 57 percent of the Boston respondents agreed with the following proposition: "Since housing prices are unlikely to drop very much, the best strategy in a slow market is to hold on until you get what you want for a property." Almost 20 percent of the respondents who had previously sold a home noted that they set their reservation price based on what they previously paid.

the volume decline in a down market may be a rational response by sellers who recognize that at current prices real estate investments have positive expected future returns.[4] Finally, the uniqueness of individual properties may prevent sellers from recognizing market-wide price changes, and thus sellers may be slow to adjust their reservation prices in a changing market, at least in the short term.

Recently Stein (1993) has proposed an alternative explanation, arguing that down payments and other borrowing constraints can add a self-reinforcing mechanism to demand shocks. When housing prices fall, equity losses on current homes may prevent potential buyers who would rely on the proceeds from the sale of their existing home for a down payment on the next from purchasing a home of equal value. Instead, they will either buy a smaller home or forgo moving altogether. The first course leads to a decrease in demand and hence an even lower price; the second, to a diminution of sales of existing homes. Together, they explain the positive correlation between volume and price. Also, in this way, initial contractions in demand are magnified. Note that the mechanism works through the asymmetric treatment of housing purchasers, who are required to contribute some equity, and incumbent owners, whose equity position may deteriorate without their being forced out of the dwelling.[5]

Using a sample of condominiums listed for sale in Boston in the early 1990s, this paper presents evidence consistent with the first predicate of the Stein model. The results indicate that housing equity does matter in owners'

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[4]See Case and Shiller (1989) and Meese and Wallace (1993) for evidence of forecastable long-run returns.

[5]Shleifer and Vishny (1992) argue for a similar feedback mechanism in the market for corporate assets when assets are industry specific and lenders require minimum levels of equity.

decisions to sell and in the list and final transaction prices. A unit with a loan to value ratio of 100 percent is 16 percent less likely to sell within any given amount of time than a unit with no mortgage; if sold, however, the first unit obtains a price 12 percent higher than the second. The data suggest that the predictions of the Stein model, which is a model about people trading homes, are borne out as strongly for investors as for owner-occupants. We suggest an explanation for investor behavior as well.

The remainder of the paper is organized as follows. Section II reviews the pertinent theoretical and empirical literature. Section III reformulates the equity hypothesis in a search framework. Section IV describes the data. Section V presents estimates of a proportional hazards model of sale, and Section VI, estimates of the regression of price on the ratio of loan to value. Section VII, which concludes the paper, discusses aggregate implications.

II. Previous Literature

We are aware of only one other theoretical model that generates a positive price-volume correlation in the market for existing homes. Wheaton (1991) shows in a search model that small movements in vacancy rates (due to shocks in demand, or changes in the search technology) can be associated with large movements in prices. The extent of trading volume in that model comes from the efficiency with which mismatched households are able to buy a new house that is well matched with their preferences. Better matching technology leads to higher prices and increased trading volume. Thus the Wheaton and Stein papers are alternative, although not mutually exclusive, explanations for the price-volume correlation.

On the empirical side, several papers provide evidence that is consistent with the equity hypothesis. One implication of the Stein model is that owners of existing homes should behave differently as buyers than do consumers who are looking to purchase their first home. Thus the trade-up market (homes purchased by existing owners) should be more responsive to the housing cycle than the first-time buyer's market. Consistent with this theory, Mayer (1993) shows that prices of high-priced homes seem to increase faster in upturns and decrease faster in downturns than those of low-priced homes. Smith and Tesarek (1991) obtain a similar result in comparing price changes of high- and low-quality homes in Houston during the 1970s and early 1980s.

Several studies show that down payment constraints do alter household behavior. Englehardt (1992), for example, shows that households reduce their consumption in anticipation of the purchase of a new home. Linneman and Wachter (1989), Jones (1989), and Zorn (1989) also find evidence that down payment requirements affect the housing tenure decision.

None of these papers provide a direct test of the equity hypothesis. For example, the cyclical behavior of trade-up home prices might be due to changes in the relative supply of various types of homes rather than differences in demand. Previous studies of mortgage constraints and household behavior look at tenure choice--the decision whether to own or rent--rather than the mobility of existing homeowners.

III. Equity and Search

We find it more natural to test the equity hypothesis within a search framework. This has the added advantage of yielding predictions about cross-sectional variations in prices. In a search model, owners do not decide

whether or not to sell at some single price. Rather, facing a distribution of offered prices, they choose a reservation price. A high reservation price brings the benefit of a higher expected transaction price, but at the cost of a longer wait until sale.

The equity hypothesis is to be reinterpreted, then, as the claim that owners with insufficient equity in their house will choose a higher reservation price. Consequently, the hazard rate of sale (the probability that a property will sell in period t given that it has survived on the market t-1 periods) will be smaller. Furthermore, transaction prices will be higher. To the extent that asking prices reflect reservation prices, they too will be higher.

An inherent nonlinearity exists in the relationship between equity and reservation price. Those owners whose equity stake in their present home is sufficiently high that they are unconstrained will be insensitive to small changes in their equity shares. But for those who are constrained--but not so encumbered by debt that moving is out of the question--every dollar more of equity is a dollar more that can be applied to the new home. For this second set of owners, the sum of the down payment constraint and the balance outstanding on the existing home puts a floor on the set of offers that the seller could accept and still move to a comparable house. Thus, we should expect to find both the hazard rate and the price to be sensitive to loan to value only above some threshold. We examine that nonlinearity in our empirical work.

Our sample is restricted to the population of units that are listed for sale. Thus we condition on the owner exhibiting some interest in selling the property. Although this might introduce a selection bias, its direction is

clear: If low equity deters listing as well, among "constrained" owners only the most eager to sell will list, and the equity effect on the sale hazard and price will be more difficult to detect. Under the null hypothesis of no equity effect in any aspect of selling, including listing, there will be no self-selection of interest.

An alternative approach would have been to model the hazard of sale among the entire population of householders. But we lack information on demographic and other factors that have been shown to predict mobility in cross sections. We would be especially worried about our inability to observe age. Young owners have less equity because they have yet to accumulate non-human capital, but they are also more mobile.

IV. Data

This paper uses data from the Boston condominium market between May 1, 1990 and December 31, 1992, a period of substantial decline in the market. In May 1990, prices were nearly triple those of eight years previous but had just started to decline. Sales had already declined by over one-third from two years previous. Subsequently, prices would fall by almost 20 percent in 1990 alone, to be followed by a 10 percent drop over the next two years. Sales would rise slightly between 1990 and 1992. These years form an appropriate time period for testing the equity hypothesis, which presupposes an unanticipated price decline.

Listing data were obtained from LINK, a privately owned listing service not associated with broker groups like the National Association of Realtors. Over this time period, LINK claims to have had a 90 to 95 percent market share in its coverage area, which includes Central Boston (Back Bay and Beacon

Hill), Charlestown, and South Boston.[6] LINK has weekly records of all properties listed, including the asking price, the realtor's name and the property's street address. (Although LINK allows properties to be listed concurrently by up to three brokers, listings were combined to a single record for each property in a week, regardless of the number of brokers involved.)

To supplement LINK, information on property characteristics and assessed tax valuations was obtained from the City of Boston Assessor's Office for all units in the three neighborhoods. The Assessor's data indicate for each year whether the owner applied for a residential tax exemption.[7] We classify all units that an exemption was applied for as owner-occupied, though clearly there is room for misclassification. Finally, Banker & Tradesman, a private firm, supplied sales prices and mortgage amounts for all property transactions between 1982 and 1992, including sales and refinancings, but not foreclosures.

LINK properties were included in the sample if they could be matched into the Assessor's data.[8] Some listings correspond to the same property being listed more than once (multiple spells). Because of the possibility of an address mismatch in a given week, or brokers gaming to get a property designated as a "new listing," a listing was considered new only if there was at least a four-week window since it last appeared in LINK. When a property

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[6]LINK lists some condominiums in East Cambridge as well as some one- to four-family properties in the city of Boston, but that information was eliminated to maintain a well-defined market.

[7]In Boston, owners can obtain a tax exemption equal to 10 percent of the city's average property tax bill by certifying that the owner lived in his/her unit on January 1st of a given tax year.

[8]A listing that failed to match had an address that was too vague for exact matching or was different from the property's legal address. The initial matching by computer was followed by a round of matching by hand.

exited from LINK, its destination was labeled either "sale" or "off-market," according to whether a sale transaction record was found in LINK.

The mortgage balance was calculated for all properties that sold or refinanced at least once after 1982, using the latest transaction available in Banker & Tradesman, and under the assumption that the owner used a 30-year fixed mortgage at the prevailing mortgage interest rate. Some transactions could not be matched with the Assessor's data and were discarded.

We normalized the mortgage balance by dividing through by an estimate of the market value of the home to obtain the loan to value ratio. Two different estimated values were used--the property's official assessed value and the previous sale price, adjusted by a resale price index. The Boston Assessor's Office computes a value based on both a hedonic method and the median price of five comparable units from recent sales.[9] Where the two methods differ significantly, the property's valuation is investigated further by the Assessor's Office. Only sales that occur prior to the assessment date are used to determine the official value. The resale price index is calculated on a quarterly basis using the value-weighted arithmetic method as in Shiller (1991) on matched sale pairs in the LINK coverage area.

We chose to focus on assessed values. Although the previous sale price captures the idiosyncracies of individual properties, it also reflects the vagaries of the previous transaction itself, such as below-market transfers of properties and distressed sales. Also, because of the relatively small size, the resale price index is a very noisy estimate of the general market level of prices. As will be seen in the next section, however, it makes little

[9]There is some adjustment of prices for small differences in attributes in this method as well.

qualitative difference which estimated value is used. Out of a total of 8,041 listings in LINK, 5,838 were successfully matched to the Assessor's Office data. We dropped properties that lacked information on a previous sale, or that had an observed loan to value ratio greater than 2. This shrank the sample to 2,381 observations (if loan to value is calculated from the assessed value) or to 2,358 observations (if loan to value is calculated from the previous sale price).

Table 1 gives means of various property characteristics for the whole sample, as well as various subsamples. The sample is restricted to condominiums in the LINK coverage area, broadly defined. Because Boston does not delineate neighborhoods in the same way that LINK does, the whole sample includes some properties that are unlikely to have been listed in LINK even if they were for sale.

The average condominium had a tax assessment of almost $200,000, but contained less than 1,000 square feet of finished space. Over half of all owners did not claim the residential tax exemption, suggesting that a large number of units are owned by investors and rented as apartments. Investor units are on average smaller and more highly leveraged than condominiums possessed by owner-occupants. LINK units are slightly larger and more expensive than the average for their area, and contain a higher proportion of owner-occupants.

V. Hazard Rate of Sale

This section estimates the contribution of equity to the hazard rate of sale--the probability that a property sells in any given week, given that an

owner has listed the property for sale in LINK and that it has not yet sold. As a preliminary step, Figure 1 shows separate Kaplan-Meier (Sale) estimates of the survivor function of weeks on the market for high and low loan to value properties. Consistent with the equity hypothesis, units owned by a seller with a loan to value greater than 80 percent stay on the market longer than properties owned by sellers with less debt. In addition to being less likely to sell, owners with high loan to values are also more likely to exit off-market. Figure 2 demonstrates this point.

Because of the likelihood that loan to value is correlated with other property attributes or differences in entry conditions, we model the hazard rate as follows:

$$h(t) = \frac{\textit{probability of selling between week } t \textit{ and week } t+1}{\textit{probability of not exiting before week } t}$$

$$= h_0(t)\, e^{\beta x}$$

where x is a vector of attributes of the property and the owner, and β is a conformable vector of parameters.

The assumption of a proportional hazard means that changes in the attributes affect the hazard by the same proportion each week a unit is on the market. Thus if unit A is half as likely to sell as unit B after one week on the market, A is also half as likely to sell as B after 10 weeks. The hazard ratio for the two properties is:

$$\textit{hazard ratio of A relative to B} = \frac{h_0(t)\, e^{\beta x_A}}{h_0(t)\, e^{\beta x_B}} = e^{\beta (x_A - x_B)}$$

and so is independent of the baseline hazard, $h_0(t)$.

We estimate the parameters by Cox's partial likelihood method. Units that remain listed but unsold at the end of our sample period, December 1992, are considered to be right censored. Properties that are delisted without sale (go "off-market") are considered to be censored at their time of exit. Although some properties go "off market" because of exogenous changes in the conditions of the household, others exit when the owners become discouraged. Under the null hypothesis of no equity effect on selling, the treatment of "off market" properties should have no effect on the estimated coefficients. Under the alternative that equity does matter, the likely bias is positive if, precisely because they are less likely to sell, high loan to value properties are more likely to go off market. The presence of this bias will make the equity hypothesis more difficult to establish.

Table 2 presents estimates of the proportional hazards model. The evidence strongly favors the conclusion that higher loan to value ratios decrease the sale hazard.

As column (1) indicates, the coefficient on the loan to value ratio is negative and highly significant, and suggests that a property with an outstanding mortgage balance equal to its assessed value would be about 80 percent ($e^{-.22}$) as likely to sell in a given week as an identical property with no mortgage. Columns (4) and (5) show that including property attributes and the inverse of the property's assessed value ($(\text{Value})^{-1}$) has little effect on the loan to value coefficient.

All specifications include year-of-entry dummies. Because prices and assessed values declined substantially over the period, loan to value ratios are much higher in 1991 and 1992 than in 1990. The dummies are included to avoid confusing any aggregate time effects with the equity effect. In fact,

the 1991 and 1992 dummy variables are significantly different from zero at the 1 percent level, and large in magnitude. We suspect that the much lower estimated hazard in 1990 than in the following years is due to the more rapid decline in prices in that year, and to the fact that owners are slow to adjust their reservation prices in the face of price shocks. Future work will examine this conjecture.

Years since last sale (at time of entry) is included in all columns since, by construction of the mortgage balance, it, too, is highly correlated with the loan to value ratio and, because of the dependence of mobility on length of tenure, may have an independent effect on the hazard. The loan to value ratio is equal to the product of two terms: the ratio of the mortgage balance at the time of (re)financing to value, and a function that is declining in the elapsed time since (re)financing. Two sellers of identical units with the same length of residence will exhibit different loan to value ratios if at least one factor among the initial mortgage balance, the prevailing interest rate, and the time since last refinancing, differs between them. As the table shows, this variable is always negative and significant. Excluding it from the list of regressors, however, has no effect on the estimates of the remaining coefficients.

Given the inherent nonlinearity in the hypothesized relationship between equity and time to sale, columns (2), (3), and (6) introduce a spline function, so that the log-hazard is piecewise linear and continuous in the loan to value.[10] This allows the sensitivity of the hazard to loan to value to differ on either side of a threshold of 0.8, which corresponds to a 20

[10]The additional variable is defined as the product of loan to value minus 0.8 and a dummy variable that equals 1 when loan to value is above 0.8 and 0 otherwise.

percent cash outlay for the down payment and closing costs, and so is consistent with the theoretical prediction that only high loan to value units--those of "constrained" households--are sensitive to equity.

Consistent with theory, the hazard rate is much more sensitive to loan to value above than below the cutoff. In fact, the coefficient on loan to value is close to zero, and no longer significant, while the spline term is negative and significant at the 2 percent level. The estimates suggest that a property with a loan to value ratio of 1 would be only 84 percent as likely to sell as a property with no mortgage ($e^{-1.00*(1-.8)+(.02*1)}$); at a loan to value ratio of 1.1, the hazard falls to only 76 percent of the no-mortgage hazard. As a check on our specification, we include a dummy variable for the absence of any mortgage in column (3). The loan to value and spline coefficients change little, while the coefficient on the new variable is not significantly different from zero.

Table 3 repeats Table 2 with the indexed previous sale price replacing the official assessed value. The estimates in the two tables are remarkably similar. For example, increasing the loan to value ratio from 0 to 1 now decreases the sale hazard by 23 percent (column (1)), rather than the 20 percent of Table 2. Notice also that the estimated coefficients on the spline term in columns (2) and (6) are almost identical using either estimate of value.

Table 4 compares the hazard rates for owner-occupants and investors. When the two groups are forced to share the same baseline hazard, whether with the spline function, as in column (2), or without (column (1)), it is impossible to reject the null that the loan to value coefficients are the same for both types of sellers. A likelihood ratio test rejects the hypothesis

that both spline terms in column (2) equal zero with approximately 95 percent confidence. When the baseline hazards are allowed to differ, the magnitude of the coefficient on the spline term for investors (column (4)) exceeds that for owner-occupants (column (3)), though not significantly so.

From the narrow perspective of the equity hypothesis, this result is surprising. The hypothesis is a story about trading homes; there is no obvious reason why it should also apply to investors. We offer a simple explanation of why investors with high debt levels are also sensitive to equity.

When the value of a property falls below the difference between the remaining loan balance and the value of the owner's other assets, the owner will default on the loan if the unit is sold. Thus, so long as rent and tax depreciation are sufficient to cover the scheduled mortgage payments, the owner is better off continuing to hold the property and waiting for it to appreciate.[11] In essence, he holds a put option. The value of the option is positive if prices follow a random walk (as in an asset model), and greater still if the long-run returns to holding real estate in a down market are positive, as suggested by Case and Shiller (1989) and Meese and Wallace (1993). For this reason, we expect investors who own units with high loan to values to attempt to avoid default by setting high reservation prices. Consequently, investor-owned units with little equity will take longer to sell and obtain higher prices. Note that if the default option is exercised and the property is foreclosed upon, we treat the exit as "off-market" and therefore censored.

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[11]If the rent falls below the mortgage payments, holding the property remains the optimal policy so long as the option value exceeds the cash outflow.

Although the argument applies to owner-occupants as well as investors, it is less relevant for owner-occupants because they face a lower cost of default. Homeowners who default will find it almost impossible to purchase another home for 7 to 10 years, and they face the possible seizure of other assets. Because investors can more easily shield their assets--including their personal residence--through incorporation or the "homestead" exemption, they face a lower cost of default. Consequently, an owner-occupant with the same equity position is more likely to accept any given offer, possibly putting up other assets to pay off the mortgage, when an investor would choose to wait for a higher price, even if waiting carries a greater risk of default.[12]

Although the two types of sellers are similar in their responsiveness to loan to value, the estimates from Columns (1) and (2) indicate that owner-occupants are between one-quarter and one-third more likely to sell than investors. This is not surprising. Owner-occupants have higher search costs: it is *their* homes that potential buyers will traipse through. And without a new home to live in and bridge financing, the opportunity to rent the property while waiting for a high price is limited.

VI. Prices

Table 5 presents the regression of the (log) transaction price on the loan to value ratio. Property attributes, the (log) assessed value, and

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[12]For this reason, lenders generally require greater initial equity from investors. Despite the additional equity, however, Freddie Mac reports that investors still have lifetime default rates that are 2.5 to 3 times higher than owner-occupants. In this sample, as a referee commented, investors in the Boston condominium market between 1990 and 1992 had especially high default rates.

dummies for the quarter of sale are also included. The coefficient on the assessed value exceeds 0.8 in the first three columns, even after separately controlling for the hedonic attributes, providing evidence that the assessed value is a very good proxy for current value.

Table 5 gives further evidence in favor of the search version of the equity hypothesis. At 0.12, the coefficient on loan to value in column (1) is positive, and significant at the 1 percent level, suggesting that owners with high loan to value levels hold out for a higher price. But unlike the hazard, price shows no evidence of the expected nonlinearity. When a spline is added in column (2), the coefficient on the spline term is positive but not significant.

As a final issue, we turn to the original asking price and consider the degree to which it acts as a proxy for the reservation price. Search models have the characteristic that seller attributes, such as loan to value, affect the transaction price and duration only through their effect on the reservation price. To the extent that the asking price reflects the seller's reservation price, this will be true of the asking price as well. Consequently, we should expect the following. First, the asking price will be a function of loan to value. Second, conditioning on the asking price will reduce the effect of loan to value on both price and time on the market. If the asking price is a perfect proxy for the reservation price, loan to value will have no independent effect on either outcome.

Column (4) shows that the original asking price does depend on loan to value. The estimates indicate that owners with a loan to value ratio of 1 set an asking price that is, on average, about 10 percent higher than the asking price set by owners who have no mortgage. This is similar to the results for

the transaction price. In fact, loan to value has no effect on price, other than through the asking price. As column (5) shows, the percent discount, which is the excess of the (log) asking price over the (log) sale price, does not depend on loan to value.[13] Constrained sellers set a high asking price, but they are no more or less likely than others to accept a given discount off the asking price.

To examine the role of the asking price further, we return to the duration analysis, and now condition the sale hazard on the ratio of the original asking price to the assessed value. Table 6, which adds this variable to the variables included in columns (5) and (6) of Table 2, shows that loan to value no longer affects the sale hazard. This is true whether or not a spline is included. Thus, here, too, we find that loan to value has no effect on the outcome, other than through the asking price. We conclude that variations in the asking price fully reflect variations in the reservation price.

VII. Conclusion

This paper shows that units with low equity take longer to sell and obtain a higher price when sold. Each week that it is on the market, a unit with an outstanding mortgage balance equal to its market value is 16 percent less likely to sell than a unit with no mortgage at all. Consistent with a strategy of holding out for a high price, the first unit will obtain a price that is 12 percent higher than the second, if both sell. These results are

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[13]When the regression in column (5) is run with the asking price on the right-hand side, its coefficient is estimated at 0.90 and is highly significant. Other coefficients in the equation are basically unchanged. In particular, the loan to value terms remain insignificant.

consistent with a search model in which constrained sellers set high reservation prices, lending credibility to the theory that initial decreases in property prices may lead to further declines in demand by reducing home equity.

Other results in the paper provide additional support to the theory. Like transaction prices, asking prices are positively related to loan to value. The theory predicts that only "constrained" sellers will be sensitive to small changes in their equity position, and, indeed, the hazard rate is responsive to high, but not low, loan to value. However, we are unable to find any nonlinearity in the relationship between price and loan to value.

Can the equity hypothesis alone explain the aggregate behavior of sales volume and prices as predicted by the Stein model? Given that condominium prices in Boston decreased by almost one-third between 1990 and 1992 (and thus loan to value ratios increased by nearly 50 percent), our estimates would predict a significant decline in the hazard rate. To the extent that low-equity units are less likely to be listed in the first place, we would expect a decrease in sales as well.

In fact, the opposite is true: both the hazard rate and sales increased over those years! Table 2 shows that properties entering the market at the end of the sample period sold twice as quickly as units entering in 1990. Figure 1 shows that 1990 marks the trough in sales as well. At most, the equity hypothesis can explain the concurrent fall in prices and sales in 1990, and the failure of sales to fully return to their previous level in the subsequent years. Although equity has some part to play, a complete explanation of aggregate behavior clearly requires an understanding of other

factors (such as the slowness of owners to adjust to changing market conditions). We are exploring these factors in ongoing research.

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Table 1
Sample Means
(Standard Deviations)

Variable	(1) All Units	(2) LINK Listings	(3) Owner-Occupants	(4) Investors
Number of Observations	21,446	2,381	1,320	1,061
1991 Assessed Value[a]	197,240 (140,540)	213,693 (134,323)	227,729 (126,520)	196,232 (141,569)
Computed Loan Balance as of 5/1/90	101,814 (152,085)	181,195 (122,153)	193,493 (119,154)	165,894 (124,149)
Loan/Value[b] Calculated Using Resale Price Index	.53 (.35)	.65 (.55)	.67 (.48)	.62 (.63)
Loan/Value[b] Using Assessed Value	.48 (.34)	.61 (.42)	.64 (.40)	.57 (.44)
Square Footage	908 (480)	973 (460)	1,002 (477)	856 (424)
Total Rooms	3.7 (1.3)	3.8 (1.3)	4.0 (1.3)	3.6 (1.3)
Bedrooms	1.5 (.7)	1.5 (.7)	1.6 (.7)	1.5 (.6)
Full Baths	1.2 (.5)	1.2 (.4)	1.2 (.5)	1.1 (.4)
Half Baths	.12 (.33)	.14 (.35)	.17 (.38)	.11 (.32)
Floor of Unit	4.0 (5.1)	3.5 (4.4)	3.4 (4.3)	3.5 (4.4)
Parking Spaces	.20 (.44)	.19 (.45)	.19 (.49)	.18 (.41)
Owner-Occupant	.43	.55	1	0
Year Built		1903	1898	1909

[a]Boston Assessor's Office prediction of January 1, 1990 value, using information prior to that date only.
[b]Calculated for all properties with a previous sale and an estimated Loan/Value < 2.

Table 2
Sale Hazard Equations
Value Is the Assessed Value in the Year of Entry into LINK
Duration Variable Is the Number of Weeks the Property Is Listed on the Market before Exiting
(Standard Errors)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Loan/Value (L/V)	-.22 (.09)	.02 (.14)	-.07 (.23)	-.20 (.09)	-.19 (.09)	.01 (.14)
(Loan/Value - .8)*(L/V > .8)		-1.00 (.42)	-.89 (.48)			-.82 (.41)
No Mortgage			-.08 (.17)			
$(VALUE)^{-1}$ (000s)					-163 (26)	-159 (26)
Years Since Last Sale	-.08 (.02)	-.08 (.02)	-.08 (.02)	-.08 (.02)	-.09 (.02)	-.09 (.02)
1991 Entry	.43 (.10)	.47 (.10)	.48 (.10)	.43 (.10)	.60 (.10)	.62 (.10)
1992 Entry	.53 (.11)	.60 (.11)	.60 (.12)	.52 (.11)	.80 (.12)	.84 (.12)
Include Property Attributes	NO	NO	NO	YES	YES	YES
Number of Observations	2,381	2,381	2,381	2,381	2,381	2,381
Log Likelihood	-4648.8	-4645.8	-4645.7	-4621.4	-4600.0	-4598
P-Value[a]		.005	.01			.03

[a]For the joint test of the hypothesis that all of the Loan/Value coefficients equal zero.

Table 3
Sale Hazard Equations
Value Computed Using Resale Price Index
Duration Variable Is the Number of Weeks the Property Is Listed on the Market before Exiting
(Standard Errors)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Loan/Value (L/V)	-.26 (.09)	-.04 (.14)	-.27 (.23)	-.23 (.09)	-.23 (.09)	-.05 (.14)
(Loan/Value - .8)*(L/V > .8)		-.98 (.47)	-.66 (.53)			-.82 (.47)
No Mortgage			-.21 (.17)			
$(VALUE)^{-1}$ (000s)					-166 (26)	-166 (26)
Years Since Last Sale	-.09 (.02)	-.09 (.02)	-.10 (.02)	-.09 (.02)	-.10 (.02)	-.10 (.02)
1991 Entry	.42 (.10)	.46 (.10)	.46 (.10)	.42 (.10)	.60 (.12)	.63 (.10)
1992 Entry	.55 (.11)	.61 (.12)	.62 (.12)	.54 (.11)	.82 (.12)	.87 (.12)
Include Property Attributes	NO	NO	NO	YES	YES	YES
Number of Observations	2,354	2,354	2,354	2,354	2,354	2,354
Log Likelihood	-4586.7	-4584.5	-4583.7	-4559.7	-4537.7	-4536.1
p-Value[a]		.003	.004			.01

[a]For the joint test of the hypothesis that all of the Loan/Value coefficients equal zero.

Table 4
Sale Hazard Equations by Owner-Occupant Status
Value Computed Using Assessed Value
Duration Variable Is the Number of Weeks the Property Is Listed on the Market before Exiting
(Standard Errors)

Variable	(1) Full Sample	(2) Full Sample	(3) Owner-Occupied	(4) Not Owner-Occupied
Loan/Value (L/V)			-.12 (.20)	-.01 (.20)
(Loan/Value - .8)*(L/V > .8)			-.87 (.55)	-1.14 (.65)
L/V* (Owner-Occupied = 1)	-.22 (.13)	-.06 (.19)		
L/V* (Owner-Occupied = 0)	-.26 (.14)	-.07 (.20)		
(L/V - .8)*(L/V > .8)* (Owner-Occupied = 1)		-1.07 (.55)		
(L/V - .8)*(L/V > .8)* (Owner-Occupied = 0)		-.83 (.63)		
Owner-Occupied	.28 (.14)	.24 (.15)		
Years Since Last Sale	-.09 (.02)	-.09 (.02)	-.05 (.03)	-.17 (.03)
1991 Entry	.42 (.10)	.46 (.10)	.30 (.12)	.67 (.16)
1992 Entry	.53 (.11)	.59 (.12)	.39 (.15)	.87 (.19)
Include Property Attributes	YES	YES	YES	YES
Number of Observations	2,381	2,381	1,320	1,061
Log Likelihood	-4614.6	-4611.8	-2603.4	-1553.6
P-Value[a]	.04	.03	.23	.05

[a]For the joint test of the hypothesis that all of the Loan/Value coefficients equal zero.

Table 5
Regressions Using Sale Price and (Original) Asking Price
Value Calculated with Assessed Value
(Standard Errors)

Variable	(1) Sale Price[a]	(2) Sale Price[a]	(3) Sale Price[a]	(4) Asking Price[a]	(5) Sale Price[a]- Asking Price[a]
Loan/Value	.12 (.02)	.10 (.04)	.16 (.06)	.10 (.03)	-.03 (.02)
(L/V - .8)(L/V > .8)		.07 (.08)	-.01 (.10)	.05 (.07)	.02 (.04)
No Mortgage			-.05 (.03)		
Years Occupied	.0003 (.004)	.0003 (.004)	.002 (.004)	-.0003 (.004)	.005 (.002)
Assessed Value[a]	.84 (.05)	.84 (.05)	.85 (.06)	1.21 (.06)	-.008 (.04)
Include Property Attributes	YES	YES	YES	YES	YES
Time Dummies[b]	YES	YES	YES	YES	YES
R^2	.84	.85	.85	.88	.24
Number of Observations	654	654	654	654	654
P-Value[c]		.001	.001	.0001	.23

[a]Denotes variables measured in logs.
[b]Equations 1-3 include dummy variables for the quarter of sale. Equation 4 includes dummy variables for the quarter of first listing. Equation 5 includes dummy variables for both the listing and sale quarters.
[c]For the joint test of the hypothesis that all of the Loan/Value coefficients equal zero.

Table 6
Sale Hazard Equations
Value Is the Assessed Value in the Year of Entry into LINK
Duration Variable Is the Number of Weeks the Property Is Listed on the Market before Exiting
(Standard Errors)

Variable	(1)	(2)
Loan/Value (L/V)	-.12 (.10)	-.01 (.14)
(Loan/Value - .8)(L/V > .8)		-.55 (.42)
Original Ask Price/Assessed Value	-.61 (.16)	-.58 (.16)
$(VALUE)^{-1}$ (000s)	-169 (26)	-166 (26)
Years Since Last Sale	-.09 (.02)	-.09 (.02)
1991 Entry	.68 (.10)	.69 (.10)
1992 Entry	.94 (.13)	.96 (.13)
Include Property Attributes	YES	YES
Number of Observations	2,381	2,381
Log Likelihood	-4591.4	-4590.5
P-Value[a]		.21

[a]For the joint test of the hypothesis that all of the Loan/Value coefficients equal zero.

Figure 1

Kaplan-Meier Survival Curve

Exit by Sale

High and Low Loan-to-Value Properties

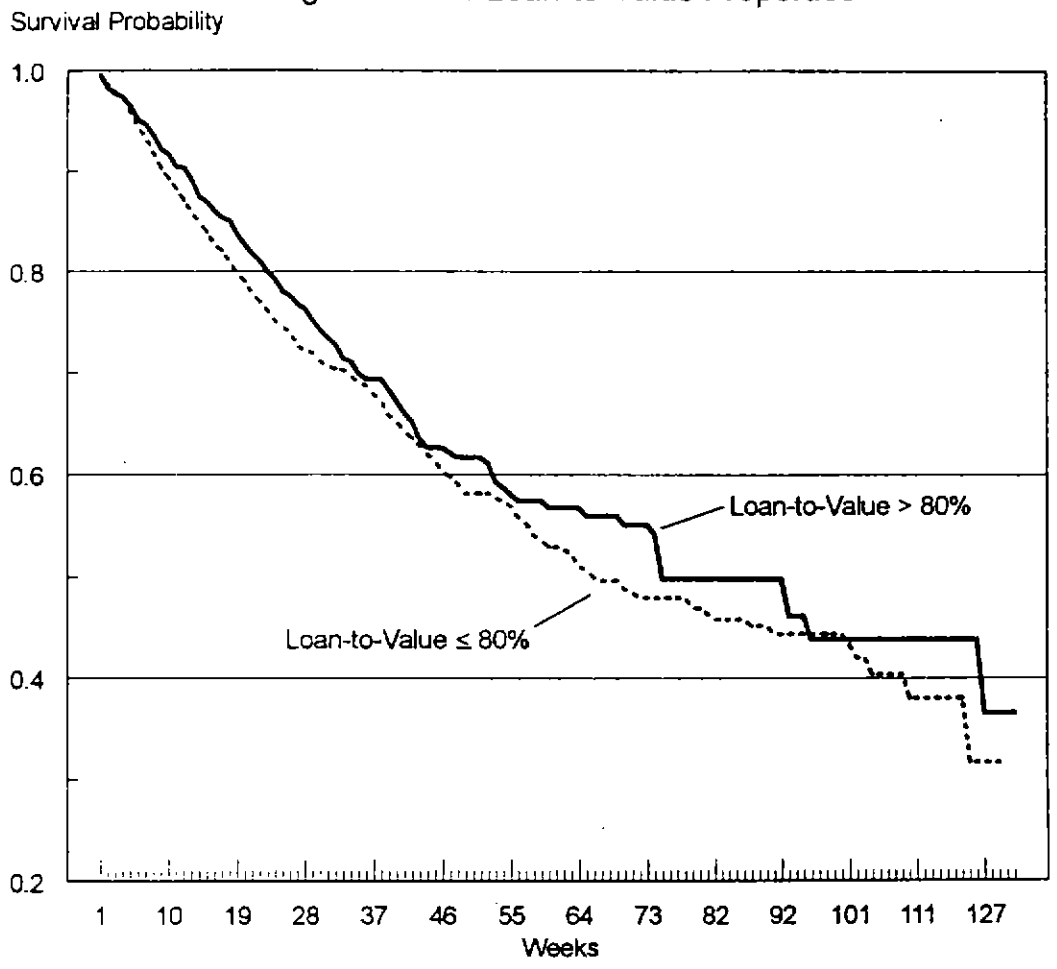


Figure 2

Kaplan-Meier Survival Curve

Exit Off-Market

High and Low Loan-to-Value Properties

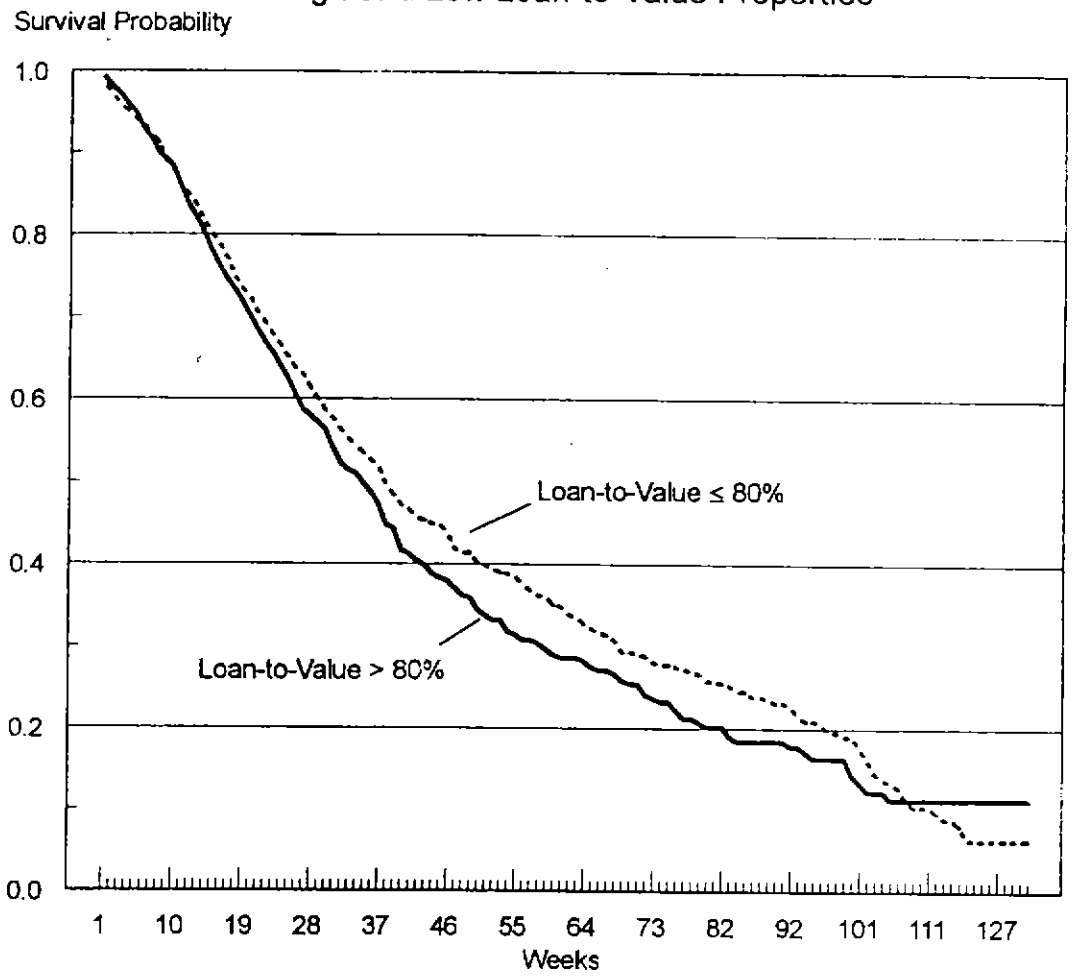
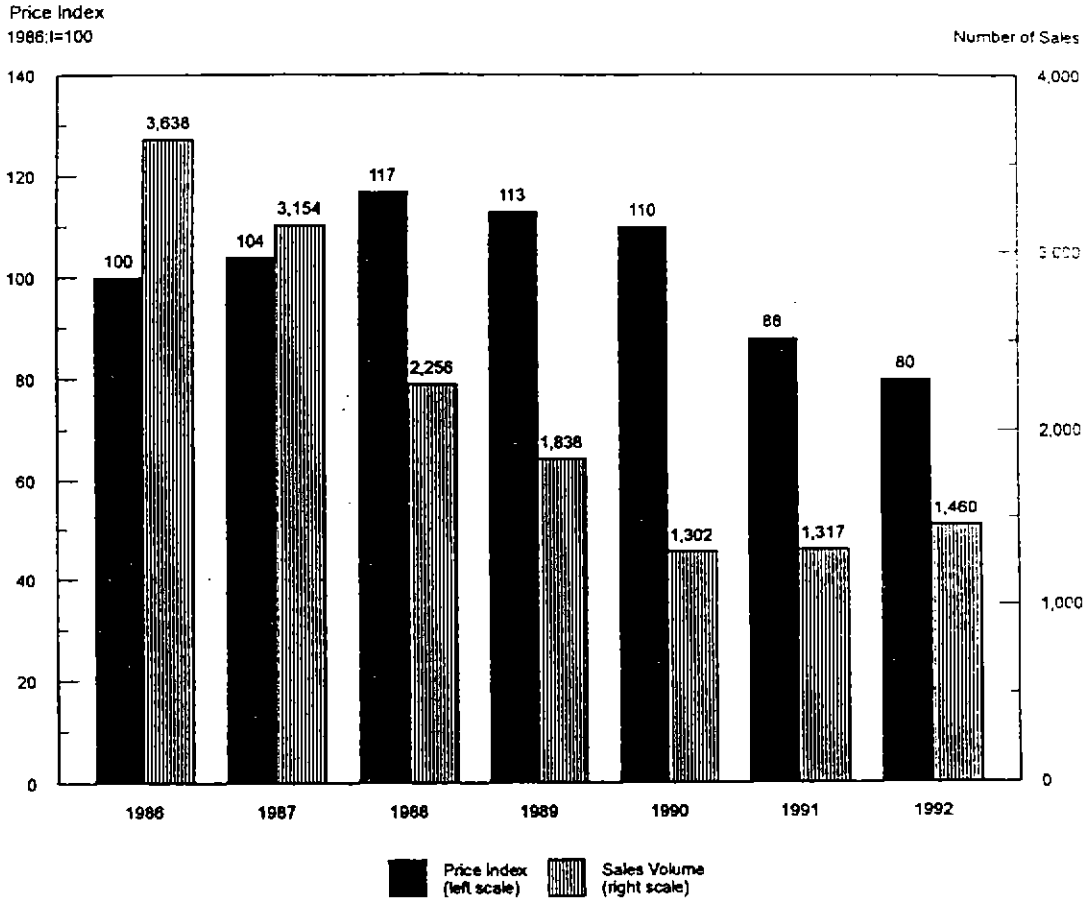


Figure 3

Price Index and Sales Volume

Boston Condominiums



Source: Banker & Tradesman and author's calculations.
The price index was calculated using an arithmetic resale price estimator and corresponds to the first quarter of each year.
The price data include matched sales in the LINK coverage area: Central Boston, South Boston, and Charlestown.