NBER WORKING PAPER SERIES

SELLING PRICE AND SELLING TIME: THE IMPACT OF SELLER MOTIVATION

Michel Glower
Donald R. Haurin
Patric H. Hendershott

Working Paper No. 5071

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 1995

An earlier version was presented at the annual AREUEA meetings, Washington, DC, January 1995. We acknowledge the support of the Center for Real Estate Education and Research at The Ohio State University and are grateful to the Harley E. Rouda (HER) brokerage company for assistance with our survey. The participation of HER was made possible by the efforts of Bud Smith, currently of The National Association of Realtors, but at that time of the Ohio Association of Realtors, and George Smith, Vice President of HER. We thank David Geltner for helpful suggestions. This paper is part of NBER's research program in Public Economics. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #5071
March 1995

SELLING PRICE AND SELLING TIME: THE IMPACT OF SELLER MOTIVATION

ABSTRACT

This study considers the role that seller motivation plays in determining sales price and selling time. We find that sale prices are directly related to the estimated value of the property *and* to the amount of over-pricing, which is directly related to the seller's level of motivation. Further, a seller who has a planned date to move will over-price less (set lower list prices relative to market value) and sell more quickly than a seller with no definite move date. A seller who is willing to move later will over-price more and sell more slowly than a seller who wants to move sooner.

Michel Glower
149 Green Valley Ct
Pittsburgh, PA 15220

Donald R. Haurin
Department of Economics and Finance
The Ohio State University
154 North Oval Mall
Columbus, OH 43210

Patric H. Hendershott
Max M. Fisher College of Business
Ohio State University
321 Hagerty Hall
1775 College Road
Columbus, OH 43210
and NBER

SELLING PRICE AND SELLING TIME: THE IMPACT OF SELLER MOTIVATION

Michel Glower, Donald R. Haurin and
Patric H.Hendershott

Early studies of the marketing time of real estate estimated the relationship between selling price and selling time (Cubbin [1974] and Miller [1978]). Later studies tried to clarify the relationship by examining the impact of list prices, interest rate levels and volatility, and degree of capitalization of special financing on marketing time (Belkin, Hempel, McLeavey [1976], Kang and Gardner [1989], Ferreira and Sirmans [1989], and Sirmans and Ferreira [1989]). Recent studies have developed simple models in which selling price and selling time are jointly determined. These studies consider the impact of atypicality of housing characteristics, over-pricing, and broker behavior on selling time and selling price (Haurin [1988], Larsen and Park [1989], Geltner, Kluger and Miller [1991], Asabere, Huffman and Mehdian [1993], and Green and Vandell [1994]). A positively sloped selling-time/selling-price schedule for a given property is well established.

How individual sellers choose particular points on the selling time/selling price schedule has yet to be examined. Because selling a house involves a trade-off between a higher price or a shorter selling time, seller preferences should be important. Sellers

who are motivated to sell quickly will have a lower reservation price and accept earlier, lower offers. Those sellers who are not motivated to sell quickly will have a higher reservation price and will only accept offers that are relatively high, even if this means an extended wait. Alternatively, sellers motivated to sell for a higher price will list higher and take longer to sell than will sellers not so motivated.[1]

This paper develops a model of seller behavior including variables that reflect the seller's motivation. From comparative static analysis of the model, we derive testable hypotheses. We then discuss our data, highlighting a survey designed to elicit the strength of seller motivation. Last, we report estimation results for both selling time and selling price. The estimates indicate the importance of seller motivation to ex post selling time and sale prices.

Theoretical Model

Consider a seller seeking a buyer for his house. He has obtained the services of a broker, who brings

---

[1] Genesove and Mayer (1994) argue that households with high current LTVs, possibly owing to declines in nominal house prices, are particularly motivated to sell for a higher price in order to have the required downpayment on their next purchase.

potential buyers to the property and some offers are made. Any number of offers can be received during a period, including zero. Let time be represented by a sequence of discrete periods of length h and let $q(n,h)$ be the probability that n offers will be made in a period of length h. If we assume that the arrival of an offer is independent of the time since the last offer, then the arrival of offers is poisson, and the probability of receiving n offers during a period of length h is

$$q(n,h) = \frac{e^{-\lambda h}(\lambda h)^n}{n!}, \qquad (1)$$

where λ is the number of offers received per period.

Each offer is an independent random draw from a distribution, $F(p)$, of offer prices, where $F(p)$ represents the probability that the offer is less than or equal to p. The seller will determine whether to accept or reject the highest offer received during the period. Once an offer is rejected, it is lost and cannot be accepted in a later period (there is no recall). We will assume that $F(p)$ is a normal distribution of offer prices with mean μ and standard deviation σ (both finite), and that the seller

(through the broker) knows the distribution of offer prices.[2]

Each period, the seller incurs a cost c of not selling the house, the cost includes both looking for a buyer and waiting to sell. For a seller who has accepted a new job some distance from his old house, the cost of waiting to sell might include carrying costs on the second house if a new house is purchased or leased at the new location, or the psychic costs of being separated from his family while they remain behind to sell the old house. The costs of not selling would also include normal upkeep and maintenance costs for the second house. For sellers who are just "testing the waters" and do not need to sell, the per-period costs are minimal.

The seller will also receive a benefit b each period from not selling the present house. The benefits from not selling might include such things as allowing children to finish the school year at their current school. In general, if per period benefits

---

[2] This assumption precludes "learning" on the part of the seller. Using this model, we cannot use seller ignorance to explain unusually high list prices. With this assumption, high list prices relative to estimated value can be explained by unusually high seller reservation prices or by the presence of unique features that are not properly valued by the estimation equation (which reflects the "average" buyer).

exceed per period costs ($b>c$), the property owner will not list the house for sale.

By waiting one more period, the seller will incur one period of costs and receive one period of benefits. He then will be faced with the same decision (wait or take the maximum offer) next period. Let $V(\underline{\Omega})$ represent the value of continuing the search for a buyer for one more period, given the seller's current level of information $\underline{\Omega}$. If p is the highest expected offer, then the seller will maximize wealth by continuing to wait if the value of waiting exceeds ($V(\underline{\Omega}) > p$). Because the same rule will apply to each future period, we can express the value of waiting as

$$V(\Omega) = E[\max[V(\Omega_{t+h}), p] \mid \Omega_t = \Omega] + (b-c)h, \qquad (2)$$

where p is the best offer expected to be received during the next period of length h and $\underline{\Omega}$ is the information that the seller will have in the next period. The first term on the right hand side is the value of next period's decision (either waiting another period $V(\underline{\Omega}_{t+1})$ or taking the maximum offer p next period, whichever is higher). The second term is the net benefit from delaying the sale one more period.[3]

If we assume that the seller knows the distribution from which the offers will be drawn, then

---

[3] For a basic introduction to search models see Lippman and McCall [1976] or Mortensen [1986].

the seller's information remains constant through time. This assumption presumes that the seller is employing a broker who knows the market and will provide advice about the distribution of potential offers.

It can be shown that under these conditions (known distribution of offer prices with finite mean and standard deviation, no recall of offers, no limit on number of offers received or on the number of periods of search, and a fixed net benefit per period for the search) the optimal stopping rule for the seller is to set a reservation price p^* and accept the first offer at or above his reservation price.[4] This stopping rule maximizes the seller's return from search $E[SP+(b-c)N]$, the expected selling price (SP) plus the expected benefits minus costs of search (computed as the per period net benefits $b-c$ times N, the number of search periods).[5] Therefore, the reservation price equals the expected gain from the optimal search strategy, which is the expected net return from the full search

---

[4] The proof is in DeGroot [1970].

[5] Note that p is the highest offer price expected to be received in a period while SP is the expected selling price -- the offer that is *accepted*.

$$p^* = E[p|p \geq p^*] + (b-c)E[N], \qquad (3)$$

where the first term on the right hand side is the expected selling price and the second term is the expected benefit of the search (the per period net benefit times the expected number of periods until an offer is accepted). The reservation price appears on both sides of equation 3 and is endogenous. The expected number of periods until an offer is accepted, $E[N]$, is the reciprocal of the probability of receiving an acceptable offer, divided by the arrival rate of offers λ:

$$E[N] = \frac{1}{\lambda \int_{z}^{\infty} \phi(z)\, dz}, \qquad (4)$$

where $z=(p^*-\mu)/\sigma$ and $\phi(z)$ is the probability density function of the standard normal distribution.

The seller will accept the maximum offer received during a period if the offer exceeds the reservation price. The expected selling price is the expected maximum offer given n offers truncated at p^*, times the probability of n offers, summed over the possible number of offers.[6]

Hypotheses

Comparative static results (Glower, 1994) reveal that an increase in net per period benefits from

---

[6] See Glower (1994) for details.

waiting increases both expected sale price and time on market directly and also raises the seller's reservation price, which increases expected sale price and marketing time indirectly. Based on these results, we have the following hypotheses regarding measures of net benefits of waiting:

Sellers with a definite move date will sell sooner and at a lower price.

We assume that presence of a definite move date indicates the seller has lower net benefits from holding the property (higher search cost). With the seller being more motivated to sell, the property is expected to sell more quickly and at a lower price.

Sellers who have listed their house for sale due to a job change or who have already made an offer on another house will list lower and sell faster and for a lower price.

Individuals who have listed their house for sale because of a change of job often must begin work in another location if the house is not sold within a limited period. They are therefore more likely to have high per-period costs of not selling including the cost of shelter in two locations and separation from family. Similarly, individuals who have already made an offer on another house are more likely to have higher costs of not selling owing to the cost of shelter in two locations. These sellers are expected

to have a lower reservation price, sell faster, and sell for less.

Sellers with over-priced houses will sell less rapidly and for more.

We assume that over-pricing indicates that the seller is not motivated to sell quickly. A less motivated seller has a lower holding cost. The implications are that this seller sets a higher reservation price, and the expected selling time and selling price are higher[7].

Based on an extension of Haurin (1988), we have the final hypothesis:

Sellers with atypical houses will sell more slowly and at a higher price.

When a house has unusual or odd features (e.g., a swimming pool in Ohio), the distribution of offers has a larger variance. The larger is the variance of offers, the higher is the reservation price and the greater is the expected sale price (see the Appendix).

Data

Information on why a seller has chosen to sell his or her property is not readily available. Property tax records generally contain information on

---

[7] Here, the arrival rate of offers is independent of over-pricing, an assumption relaxed by Green and Vandell (1994). Over-pricing is also assumed to be independent of the atypicality of the house.

sale dates and prices and property characteristics, but do not indicate how long the property was on the market or why the property was being sold. The Multiple Listing System (MLS) contains information on how long a property has been on the market, as well as information about property characteristics, but does not contain information on why the seller has decided to sell the property. In fact, the reason for selling is highly guarded because the broker is acting as the seller's agent, and if information on the seller's position makes its way to a potential buyer, the buyer might be able to use this knowledge to her advantage (say, making a lower offer to a seller who is known to be in extreme financial difficulty) and the seller-agent relationship would be compromised.

In order to obtain information on the seller's motivation, data were collected using a telephone survey of sellers who had listed their homes for sale with the Harley E. Rouda (HER) brokerage in the Columbus, Ohio area. From April 30, 1990 to December 31, 1991, agents at participating offices asked each new seller to participate in the study. Participation entailed the seller receiving one phone call asking their reason for selling, along with some other information.

As soon as we received notification of participation (generally within two weeks of the list date), we called the seller and asked a series of survey questions intended to elicit responses that

would allow estimation of the seller's time constraint, of his costs of searching for a buyer, and his costs of ending the search without a sale. Each of these observations is called a participating listing. Data relating to the participating listing's house characteristics (number of bedrooms, baths, etc.) are obtained from the Multiple Listing Contract, from PACE books, or from the property records in the county courthouse.[8] The usable survey sample size is 121. Each seller was asked whether they had a moving date in mind. Three families had already moved (all within two weeks of the initial listing), 79 provided specific moving dates and 42 had no definite moving date.

The number of days on the market is computed as the number of days between the initial listing date and the date of the closing for the properties that sold. If the property had been listed for sale with another broker or agent or had been for sale by owner immediately (within three months) before the HER listing agreement was signed, the observation was

---

[8] PACE (Prompt, Accurate, Concise, and Easy-to-read) property transfer books are published by Amerestate, Inc. of Cincinnati, Ohio. Amerestate collects data from property tax records and property transfers at county courthouses throughout Ohio. These data are then published by county in alphabetical order by street address or in magnetic form and are provided (for a fee) to interested parties.

classified as a re-listing (properties) and the seller was asked when the property was initially placed on the market. This initial listing date was used to compute days on the market. For those observations that did not close before December 31, 1991 (the termination point of data collection), the observation is considered "censored" and days on market is computed as the number of days between the initial listing date and December 31, 1991. The impact of seller motivation on selling time is analyzed using the proportional hazards regression method proposed by Cox [1972], which easily accommodates censored data.

Analysis of the effect of seller motivation on selling price requires measures of atypicality of each property and an estimated selling price. The limited survey observations are insufficient to compute estimated selling prices. Rather, hedonic regressions are estimated using PACE data for 1990 and 1991 for Franklin county and the city of Pickerington. The estimated coefficients were used to compute measures of atypicality and over-pricing for the survey observations (an appendix, available from the authors, provides details about the hedonic regressions).[9]

The atypicality index was computed as a percentage of the estimated house value:

---

[9] Regression coefficients were estimated using OLS regressions on 7,247 PACE observations. The dependent variable was the natural log of selling price; the adjusted R-square was 0.6586.

$$ATYP = \frac{\sum_{i=1} |\exp[a+b_i h_i] - \exp[a+b_i h^*_i]|}{V} 100 \qquad (5)$$

where h_i are physical traits of the property (locational traits are excluded), h^*_i is the mean value from the PACE dataset for each characteristic, and a and b are the coefficient estimates from the hedonic regressions. The measure of over-pricing was computed as the difference between list price and the estimated value of the survey property, taken as a percent of the estimated value:

$$OP\% = \frac{LIST - (a+\sum b_i h_i)}{a+\sum b_i h_i} 100 \qquad (6)$$

where *LIST* is the list price of the property. Table 1 contains means and standard deviations for selected variables from the telephone survey sample.

Results

We first present tests of the impact of seller motivation on selling time. Proportional hazards regressions are used for the test. The second set of results presents tests of the impact of seller motivation on selling price. Both simple OLS regressions and two step regressions using a sample selection bias correction procedure are used.

Seller Motivation and Selling Time

We use survival analysis to study individuals who have listed their houses for sale. The sale of

each property constitutes failure. Survival analysis requires special techniques because the data are not always complete (some observations may not fail before the study is terminated), and the usual parametric assumptions may not be justified. The two most popular models used to analyze survival data are the accelerated failure time models described in Kalbfleisch and Prentice [1980] and the Cox proportional hazards model (Cox [1972]). We use the Cox model because it more easily accommodates censored data.[10]

The survival time of each observation is assumed to follow its own hazard function

$$h_t(t) = h(t; z_i) = h_0 \exp(z_i \beta), \qquad (7)$$

where $h_0(t)$ is the baseline hazards function, z_i is the vector of explanatory variables for the ith individual, and β is the vector of regression parameters. The baseline survivor function is

---

[10] One possible problem with the application of survival models to real estate sales is that the seller may decide not to sell the property and withdraw the listing. In these cases, the property will never be sold and there will not be a defined end point. In the case of the telephone survey sample, sellers were contacted only once (at the time of the initial listing with HER), and we cannot identify which of the properties that were still unsold at the survey cut off date (December 31, 1991) had not closed because the sellers had decided not to sell.

$$S_0(t) = \exp\left(-\int_0^t h_0(u)\,du\right). \quad (8)$$

The relevant explanatory variables are the motivational variables discussed in the hypothesis section.

The results from the proportional hazards estimations are shown in Table 2. The top number in each explanatory variable's cell is the parameter estimate. The second number is the standard deviation of the estimate, and the third is the Wald chi-squared statistic, computed as the square of the parameter estimate divided by its standard error. The number of asterisks indicates the significance of the parameter estimates: one asterisk indicates the 5% level, and two is 1%.

Five motivation variables are tested. An increase in the first two, Days Until Desired Move Date and the No Move Date Dummy (long time to desired move date), is expected to increase selling time, which means that the probability that the house has sold by day x will be reduced as the variable is increased. Therefore, the coefficients should be negative. They are and also are significant at the 1% level. The next pair of variables are the Already Made Another Offer and the Job Change dummies. Unity values for these should shorten selling time, which means that the probability that the house has sold by

day x will be increased. Both coefficients are positive and significant at the 5% level.

The other two variables are Percentage Over-Priced and the Atypicality Index. Coefficients on both are expected to be negative (as the variables increase, the probability that the house has sold by day x will decrease). Both coefficients are negative; that on over-pricing is significant at the 5% level, but that on atypicality is insignificant (significance level is 13%).[11]

For sellers with a desired move date 85 days away, a property with a mean atypicality index (23%) and a list price at the mean difference between it and the estimated value of the property (26%), the probability of the property having sold by the 100th day is 30%.[12] If the seller has an offer on another house, the probability increases to 45%. For sellers without an offer but changing jobs, the probability rises to 47%.

Table 3 shows the probability of the property having sold by day 100 when days to desired move and

---

[11] Buyer population variables (dummy variables for the season listed, the volume of closings) were included in separate regressions and were found to be insignificant.

[12] Recall that the derivation of this index involves comparison of actual list price and an estimated value from another sample. Thus the mean values need not be near zero.

over-pricing are varied. Assuming no offer on another house or change in job, the probability that a seller who wants to move in 25 days and has over-priced by one standard deviation below the mean will have sold before the 100th day is 45%. At the mean, the probability is 39%, and at one standard deviation above the mean, the probability of selling by day 100 is cut by another fifth. An increase in the desired move date from 25 to 125 days has an impact similar to over-pricing by a standard deviation. Sellers who have no definite move date have the lowest probability of having sold.[13]

Seller Motivation and Selling Price

Regression estimates explaining selling price are presented in Table 4. Regression 1 is simple OLS using the 90 observations that sold. This regression verifies the positively sloped selling-time/selling-price schedule for a given property (because this sample is selective -- sold properties only -- the standard errors may be biased). Explanatory variables are the estimated value of the property, the atypicality index, and the selling time. The coefficients on estimated value and atypicality are

---

[13] In their sample of Boston condominium owners, Genesove and Mayer (1994) find that a high loan-to-value ratio, which indicates strong motivation to sell for a high price, increases both the time to sale and the sales price.

positive: as value and atypicality rise, selling price increases. As expected, the coefficient on selling time is positive; according to the equation, the seller obtains an additional $59 for every day of selling time. Regression 2 repeats this estimation, but with the log of price on the left hand side and the log of estimated value on the right.

In regression 3, we have replaced the endogenous time-on-market variable with the determinants of an individual's choice of a particular point on the time/price schedule, i.e., with the seller motivation variables used in selling time estimates (Table 2). Because the coefficient estimates may be subject to selection bias, Heckman's two step method is employed. All 121 observations are used in the first step probit estimation of whether the property sold, and only the 90 observations that closed are included in the second step estimation listed in the table. The estimated value and the percent of over-pricing are significant at the 1% level. None of the other variables are significant. Similar results are obtained when the regression is estimated in log form.[14]

To determine whether over-pricing is truly an indicator of seller motivation, we regress percentage

---

[14] We also tested a quadratic in over-pricing, but found its coefficient to be insignificant. Green and Vandell (1994) estimate a similar equation and find the coefficient of squared over-pricing to be rather unstable.

over-pricing on the other motivation variables. The results are presented in Table 5. The coefficients of the two main seller motivation variables, days to desire move and the no-move date dummy, are both significant and positive.[15] Highly motivated sellers (those with few days to desired move) list their properties at lower prices than do less motivated sellers. To illustrate, someone desiring to move in 25 days (85 day mean value less a half standard deviation) will list their $100,000 estimated-value house lower and sell it for 10 percent less than someone desiring to move in 144 days (mean plus a half standard deviation).

Conclusions

Previous studies have shown that a trade-off exists between selling faster and selling for a higher price. Our OLS regressions confirm this finding that a price-time curve exists and is upward sloping. Previous studies also examined the effects of variables that shift the P/T curve: atypicality, season (a measure of buyer activity), broker size, commission rate, and listing contract duration. We find that atypical properties (which have smaller buyer populations) take longer to sell, but the significance of this finding is marginal. Buyer activity level (as measured by season or the number of

---

[15] Again, buyer population variables added nothing to the explanation.

closing) is insignificant in explaining selling time if seller motivation is controlled for; this result may reflect the stability of interest rates during our sample period.

Our study extends prior analysis by showing how a seller chooses a particular point on the price-time curve (a specific combination of expected selling price and time to sale). We show that seller motivation is a key factor and that the nearness of the seller's desired move date is a good indicator of the seller's motivation level. In addition, the level of over-pricing (the difference between the list price and the estimated value of the property, expressed as a percent of value) is inversely related to the seller's motivation level: less motivated sellers set higher list prices relative to market value. We conclude that less motivated sellers' properties take longer to sell, but sell for higher prices than comparable properties of more motivated sellers.

REFERENCES

Asabere, P., F. Huffman and S. Mehdian. 1993. Mispricing and Optimal Time on the Market. *Journal of Real Estate Research* 8:149-156.

Belkin, J., D.J. Hempel, and D.W. McLeavey. 1976. An Empirical Study of Time on Market Using Multidimensional Segmentation of Housing Markets. *AREUEA Journal* 4:57-75.

Cox, D.R. 1972. Regression Models and Life-Tables (with Discussion). *Journal of the Royal Statistical Society* Series B 34:187-220.

Cubbin, J.S. 1974. Price, Quality, and Selling Time in the Housing Market. *Applied Economics* 6:171-187.

DeGroot, M.H. 1970. Optimal Statistical Decisions, New York, New York, McGraw-Hill Inc.

Ferreira, E.J. and G. Stacy Sirmans. 1989. Selling Price, Financing Premiums, and Days on the Market. *Journal of Real Estate Finance and Economics* 2:209-222.

Geltner, D., B. Kluger and N. Miller. 1988. Optimal Price and Selling Effort from the Perspectives of the Broker and Seller. *AREUEA Journal* 19:1-24.

Genesove, D. and C. J. Mayer. 1994. Equity and Time to Sale in the Real Estate Market. NBER Working Paper No. 4861.

Glower, M. 1994. List Prices, Selling Prices and Days to Closing: The Impact of Seller Motivation. Ohio State University Ph.D. Dissertation, Columbus.

Green, R., K. Vandell. 1994. Optimal Asking Price and Bid Strategies for Residental Sales, working paper, University of Wisconsin, Madison.

Haurin, D. 1988. The Duration of Marketing Time of Residential Housing. *AREUEA Journal* 16:396-410.

Heckman, J.J. 1978. Sample Selection Bias as a Specification Error. *Econometrica* 47:153-161.

Kalbfleisch, J.D. and R.L. Prentice. 1980. The Statistical Analysis of Failure Time Data, New York, John Wiley and Sons, Inc.

Kang, H.B. and M. Gardner. 1989. Selling Price, Listing Time, Housing Features, and Marketing Time in the Residential Real Estate Market *Journal of Real Estate Research* 4:21-36.

Kang, H.B. and Alan K. Reichert. 1991. An Empirical Analysis of Hedonic Regression and Grid-Adjustment Techniques in Real Estate *AREUEA Journal* 19:70-91.

Larsen, J.E. and W.J. Park. 1989. Non-Uniform Percentage Brokerage Commissions and Real Estate Market Performance. *AREUEA Journal* 17:422-438.

Lippman, S.A. and J.J. McCall. 1976. The Economics of Job Search: A survey, *Economic Inquiry* 14:155-189.

Michaels, R. G. and V.K. Smith. 1990. Market Segmentation and Valuing Amenities with Hedonic Models: The Case of Hazardous Waste Sites. *Journal of Urban Economics* 28:223-242.

Miller, N.G. 1978. Time on the Market and Selling Price. *AREUEA Journal* 6:164-174.

Mortensen, D.T. 1986. Job Search and Labor Market Analysis. Chapter 15, *Handbook of Labor Economics*, Volume II, edited by O. Ashenfelter and R. Layard, Elsevier Science Publishers BV, pp 849-919.

Sirmans, G.S. and E.J. Ferreira. 1989. Time on the Market and Financing Premiums. *The Journal of Real Estate Appraisal and Economics* Spring 1989:55-59.

Zorn, T.S. and J.E. Larsen. 1986. The Incentive Effects of Flat-Fee and Percentage Commissions for Real Estate Brokers. *AREUEA Journal* 14:24-47.

APPENDIX

Under our assumptions and b = 0, the reservation price, using Haurin's 1988 framework, is:

$$p^* = \mu + \phi(z)\sigma E(N) - cE(N). \qquad \text{(A-1)}$$

He shows that

$$dE(N)/d\sigma = \phi(z)cE(N)^3/\sigma^2 > 0. \qquad \text{(A-2)}$$

Further, because

$$SP = p^* + cE(N), \qquad \text{(A-3)}$$

we find:

$$dSP/d\sigma = \phi(z)E(N) + \phi(z)c^2E(N)^3/\sigma^2 > 0. \qquad \text{(A-4)}$$

That is, an increase in the variance of the distribution of offers raises a seller's reservation price, the expected number of offers received, and his expected sales price. Because increased atypicality is assumed to increase the variance of offers, increased atypicality raises the selling price.[16]

---

[16] Highly motivated sellers are assumed to have a high holding cost c. Thus in the context of this model, highly motivated sellers are expected to sell quicker and at a relatively low price (the derivatives of E(N) and σ with respect to c are negative).

Table 1: Summary Statistics for Survey Sample Variables

Variable	Mean	Standard Deviation
Days to Close*	185.356	148.843
Days to Close or End of Study	278.364	218.954
Days to Desired Move	84.595	118.603
No Move Date	0.364	0.483
List Price	112,560	58,875
Over-Price Percentage	25.807	34.076
Atypicality Percentage	22.627	18.89
New Job or Transfer	0.273	0.447
Already Made Offer	0.331	0.472
Relist	0.174	0.360
Number of Bedrooms	3.25	0.72
Number of Full Baths	1.67	0.64
Number of Partial Baths	0.55	0.53
Square Footage	1,601	585
Acres	0.44	0.743
Age	25.53	16.32
Median Income of Census Tract	43,520	11,812

*Sold properties only, n=90; n=121 otherwise.

Table 2: Selling Time: Estimated Parameters from Proportional Hazards Regression

Parameter Estimate, (Standard Error), **Wald Chi-Square**

Log Likelihood Chi-Square	**41.167**
p value	**0.0001**
Days Until Desired Move	-0.0054 (0.0019) **8.3****
No Move Date Dummy	-1.23 (0.34) **13.1****
Already Made Offer Dummy	0.522 (0.223) **5.5***
New Job or Transfer	0.570 (0.239) 5.7*
Over-Priced Percentage	-0.0080 (0.0041) **3.7***
Atypicality Percentage	-0.0010 (0.0066) **2.3**

* significant at the 5% level
** significant at the 1% level

Table 3: Impact of Over-Pricing on Selling Time
Probability (In Percentages) That the Property Is Sold By Day 100

	$\mu-\sigma^*$	$\mu-0.5\sigma$	μ	$\mu+0.5\sigma$	$\mu+\sigma$
25 Days to Desired Move	45.3	43.0	38.7	34.8	31.1
85 Days to Desired**	35.4	33.4	29.8	26.6	23.6
144 Days to Desired Move	27.2	25.6	22.7	22.0	17.8
203 Days to Desired Move	20.6	19.3	17.1	15.1	13.3
No Move Date	18.4	17.2	15.2	13.4	11.8

*μ is the over-priced sample mean, σ is the over-priced sample standard deviation.

**The mean days to desired move is 85 and the standard deviation of days to desired move is 119.

Table 4: Sale Price

Coefficient, (Standard Error), **t-Statistic**

	Regression 1 OLS	**Regression 2 OLS**	**Regression 3 Two Step**	**Regression 4 Two Step**
Dependent Variable	**Sale Price**	**Log(Sale Price)**	**Sale Price**	**Log(Sale Price)**
n (step 1, step 2) Adjusted R-Square	90 .65	90 0.71	121,90 0.86	121,90 0.56
Intercept	20,578 (10,115) **2.03****	1.941 (1.097) **1.77***	-2,963 (11,550) **-0.257**	2.792 (1.076) **2.59*****
OLS Estimated Value	0.786 (0.098) **8.04*****	0.829 (0.097) **8.57*****	0.891 (0.050) **17.7*****	0.745 (0.091) **8.16*****
Atypicality Percentage	423.74 (148.64) **2.851*****	0.0026 (0.00136) **1.893***	209.2 (163.7) **1.278**	-0.0014 (0.0032) **-0.432**
Days to Closing	59.22 (21.13) **2.80*****	0.00055 (0.00017) **3.241*****		
Lambda			-3,290 (25,910) **-0.127**	0.067 (0.501) **0.134**
Over-Priced Percentage			955.12 (92.62) **10.312*****	0.0056 (0.0018) **3.03*****
Days to Desired Move			-8.90 (27.89) **-0.319**	0.00091 (0.00053) **1.719***
No Move Date Dummy			-2,633 (7,316) **-0.360**	0.095 (0.140) **0.683**
New Job or Transfer Dummy			4,532 (7,398) **0.613**	-0.028) (0.142) **-0.195**
Already Made Offer Dummy			2,604 (10,052) **0.248**	0.092 (0.203) **0.452**

* significant at the 10% level
** significant at the 5% level
*** significant at the 1% level

Table 5: Over-Price Percentage

Coefficient, (Standard Error), **t-Statistic**

n **Adjusted R-square**	**121** **0.11**
Intercept	11.19 (6.92) **1.62**
Days to Desired Move	0.11 (0.03) **3.71****
No Move Date Dummy	16.49 (7.81) **2.11***
Percent Atypicality	0.14 (0.11) **1.31**
Offer Made Dummy	-2.27 (6.55) **-0.35**
New Job or Transfer Dummy	-2.08 (7.10) **-0.29**

* significant at the 5% level
** significant at the 1% level