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Bigger is Not Better: Brokerage and Time on the Market

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Abstract. **We examine the relationship between the seller's choice of a real estate agent/firm and the time it takes to sell his property (TOM). We find that neither the commission rate of the selling agent nor the size of the listing firm has a significant impact on TOM. Our results also indicate that an increase in the number of listings by the listing agent increases TOM while an increase in the number of house sales by the listing agent decreases TOM. We fail to find empirical support for the argument that brokerage firms and agents expend more effort to sell their own listings.**

Introduction

A house seller desires to maximize the price he[1] gets for the house *and*, at the same time, minimize the time it takes to sell the house. These objectives may also affect his decision whether or not to employ a real estate agent, and his choice of which real estate agent/firm to employ. A number of theoretical and empirical studies have examined the impact of brokerage on housing prices (see Yavaş, 1993, for the literature review). Our objective in this paper is to look at the impact of brokerage on the second objective of the seller; we investigate the relationship between the seller's choice of a real estate agent/firm and the time it takes to sell his property (hereafter Time On the Market, or simply TOM).

More specifically, we examine the relationship between TOM and the following brokerage variables: selling agent's commission, size of the listing firm, whether or not the property was sold by the listing agent (or by the listing firm), total number of properties listed by the listing agent, and total number of properties sold by the listing agent. We utilize a duration model in our empirical tests.

There exist several empirical studies of TOM using duration models. Haurin's (1988) study of TOM is one of the early applications of duration models in housing markets. His paper differs from ours in that his focus is on the impact of the atypicality of residential properties on TOM. He confirms that TOM of an atypical house is relatively longer than that of an average house. The only brokerage variable in his model is the size of the brokerage firm. He finds that an increase in the size of the brokerage firm reduces TOM.

Larsen and Park (1989) also use a duration model to study TOM. In addition to the size of the brokerage firm, they also include the sales commission rate in their analysis. As in Haurin (1988), they find that an increase in the size of the listing brokerage firm reduces TOM. On the other hand, Larsen and Park (1989) report that an increase in the percentage commission for the selling agent results in longer TOM. Their explanation for this result is that a higher commission rate leads to a higher reservation price for the seller

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Date Revised—November 1994; Accepted—November 1994.

(which prolongs TOM) and this negative effect outweighs the positive effect of a higher commission on brokerage search effort levels.

Our study can be considered as an extension of Larsen and Park (1989). We extend their analysis by incorporating additional brokerage-related explanatory variables. The current model also differs from our earlier work (Yavaş and Yang, 1995) and from the TOM models of Belkin, Hempel and Mcleavey (1976), Kang and Gardner (1989), Miller (1978), and Miller and Sklarz (1987) in that the question of interest here is the impact of brokerage-related factors on TOM, whereas those studies emphasize the role of the listing price strategies in determining TOM. Another related study, Sirmans, Turnbull and Benjamin (1991), studies TOM in conjunction with the housing price and brokerage commission. However, their analysis as well as the above papers uses a linear regression model, hence restricting itself to a particular density function for TOM. Here, we assume a Weibull distribution, which allows for a variety of shapes for the density function. A comparison of our results with those of Sirmans, Turnbull and Benjamin will be discussed later in the text.

Our results can be summarized as follows. Neither the commission rate of the selling agent nor the size of the listing firm has a significant impact on TOM. These results support our theoretical predictions. Furthermore, in line with our theoretical predictions, the results also show that an increase in the number of listings by the listing agent increases TOM while an increase in the number of house sales by the listing agent decreases TOM. On the other hand, while we expect firms and agents to expend more effort to sell their own listings, we fail to provide empirical support for this claim. Our results indicate that the firms/agents do not sell self-listed houses any faster than those listed by other firms/agents.

We discuss theoretical predictions about the impact of brokerage variables on TOM in section two. Section three sketches the duration model employed in this study. Section four presents the empirical test and results, and section five provides some concluding remarks.

Theoretical Predictions

The theoretical predictions presented below are based on the premise that the duration of a listing is primarily determined by, and is inversely related to, the search effort expected by brokerage on that listing. For that reason, we study the factors that can influence the broker's search effort for a given listing.

The analysis begins with the relationship between the commission revenue generated by a listing and the TOM of that listing. Common sense dictates that a higher commission revenue should induce greater effort from the brokers, hence resulting in shorter TOM. However, the search effort required to sell a high price house may exceed that of a low price house. Therefore, we need to control for price differences among the properties. Once we do so, we would expect an inverse relationship between the commission rate of the selling agent and TOM.

On the other hand, a higher commission rate for the selling agent may also signal that it is harder and more costly to sell the property (e.g., a property in the countryside may be more costly to show to buyers than a property in town).[2] Listing brokers are believed to negotiate a higher-than-average commission rate for such properties, and in return, they offer a higher commission rate to the selling agents. Hence, while a higher sales commission rate offers more incentive for selling agents to search, it may also indicate a greater pobability that their search effort will yield no sale. Since the latter effect comes from characteristics of the property that are not captured in our data set, we cannot separate the two effects in our analysis.

Larsen and Park (1989) also indicate that a higher commission rate may result in a higher reservation price for the seller. This reduces the price concessions the seller is willing to make in negotiations and decreases the probability of finding a buyer willing to pay the higher reservation price.

Claim 1: The relationship between the selling agent's commission rate and TOM is ambiguous; it depends on the magnitudes of the above-mentioned opposing effects.

Our data include only the commission rates offered by listing agents to selling agents. It does not include the commission rates retained by the listing agents. Nevertheless, in the presence of a Multiple Listing Service (MLS), it is the selling agent's commission rate that determines the search efforts of the potential selling agents (except the search efforts of the listing agent which depend on her share of the commission as the listing agent as well as a potential selling agent). For that reason, we consider the selling agent's commission rate to be the major determinant of TOM. This also follows the theoretical argument of Miceli (1991) that a listing will attract more brokerage efforts as the *selling agent* is awarded a greater portion of the commission.

For any given commission rate, search theoretical models argue that there could be "scale effects" associated with brokerage services. More specifically, larger brokerage firms (firms with a large number of agents) may enjoy positive economies of scale from retaining larger pools of listings, and therefore attract more potential buyers. Larger pools of listings and potential buyers may facilitate a better matching technology and/or lower the average contacting and showing costs within the firm. However, in the presence of MLS, the size of the brokerage firm chosen for listing should not matter; each listing is equally accessible to all MLS members. Thus, the size of the listing pool available for each firm is effectively the same. If this is common knowledge to the buyers in the market, then they should not care about the size of the listing firm. This leads to the following prediction.

Claim 2: MLS eliminates any scale effects; the size of the listing firm should not affect TOM.

Another interesting factor would be whether or not the agents in a given firm allocate more effort to sell the properties that are listed by other agents in the same firm vis-à-vis the properties listed by agents in other firms. It is common practice for a brokerage firm to give more monetary incentives to its agents to sell listings originating within that firm. One reason for this is that it raises the sale performance of the firm, hence improving its reputation. Another reason is that the agents share their commissions with their firm at a predetermined ratio. Thus, if a firm's listing is sold within that firm, then the firm collects commission from both the listing and the selling agent. In addition to the monetary incentives offered by the firm, an agent may also prefer to sell the listing of another agent within the same firm simply because of the reduced transaction costs between the listing and the selling agent.[3]

Claim 3: The properties listed and sold by the same firm have a shorter TOM.

A similar argument can be applied to individual agents as well. An agent is expected to expend more effort to sell her own listings. The reason is that if the agent sells some other agent's listing, then she has to share the commission with the listing agent, whereas she receives the whole commission if she sells her own listing.[4]

Claim 4: The properties listed and sold by the same agent have a shorter TOM.

Claim 4 also implies the following prediction. Given that an agent chooses to focus on her own listings, as the number of listings of an agent increases, she can spend less time on each listing. This could result in an increase in the TOM of properties listed by that agent.[5]

Claim 5: The TOM of a property is an increasing function of the number of listings of the listing agent.

However, agents might differ with respect to their experience, reputation and ability. These differences may influence their effectiveness in selling a property. One proxy for such differences between agents could be the number of properties sold by each agent. Given Claim 4, it would therefore be a good strategy for a seller to list the property with an agent who has a good selling record.

Claim 6: The TOM of a property is inversely related to the number of properties sold by the listing agent.

Our objective in this paper is to provide an empirical test of the above claims. Before we present our results, we provide a brief discussion of our empirical model in the next section.

Duration Models

Existing empirical studies on TOM employ two types of models, log-linear OLS regression models and duration models with specific survival functions. Regression models of TOM are more popular in these studies (Belkin et al., 1976; Kang and Gardner, 1989; Miller, 1978; Sirmans et al., 1991; Yavaş and Yang, 1995). These models place restrictive assumptions on the distribution of TOM, and produce biased results when the assumptions are violated. Instead, this study utilizes a duration model with a Weibull distribution. In this section, we provide a brief discussion of the model.

Define TOM as a random variable, t, with the distribution function $F(\tau)=P(t<\tau)$ denoting the probability that t is less than some value τ. The survival function, $S(\tau)$ (i.e., the probability of the house not being sold at time τ) is specified as:

$$S(\tau)=P(t\geq\tau)=1-P(t<\tau)=1-F(\tau)\ .$$

A particularly useful function for duration analysis is the hazard function, $\lambda(\tau)$ (i.e., the probability that the house will be sold at time τ, given that it has not been sold until τ), and is defined as:

$$\lambda(\tau)=f(\tau)/S(\tau)\ ,$$

where $f(\tau)$ is the density function corresponding to the distribution function $F(\tau)$. By the above definitions, the relation of the survival function and the hazard function can be revealed as:

$$\lambda(\tau) = -d\ln S(\tau)/d\tau\,,$$

or equivalently,

$$S(\tau) = \exp\{-\int_0^\tau \lambda(\nu)d\nu\}\,.$$

Note that since the density, survival and hazard functions can be derived from each other, they are three equivalent ways of describing the pattern of TOM.

A widely used distribution for the duration function is the exponential distribution. Although it is simple to work with, the exponential distribution has the disadvantage that it specifies the hazard rate as a function of exogenous variables, but not as a function of TOM. Thus, it does not allow the hazard rate to change over time. This problem can be easily avoided by employing other distributions. A commonly used alternative distribution function in duration studies is the Weibull distribution.

The Weibull distribution is a generalization of the exponential distribution with two parameters, α and β (α>0 and β>0). Using the above relationships among $F(\tau)$, $S(\tau)$ and $\lambda(\tau)$, the specifications of distribution, survival and hazard functions using the Weibull distribution become:

$$F(\tau) = 1\text{-}\exp(-\Theta\tau^{\alpha}); \qquad \text{(i)}$$

$$S(\tau) = \exp(-\Theta\tau^{\alpha}); \qquad \text{(ii)}$$

and

$$\lambda(\tau) = \alpha\Theta\tau^{\alpha-1}, \qquad \text{(iii)}$$

where $\Theta(x) = \exp(-x\beta)$, α is a parameter that determines the distribution function, x is a vector of exogenous explanatory variables, and β is the vector of parameters of x. It can be easily verified that the exponential distribution is a special case of the Weibull distribution with $\alpha=1$. Note that $\lambda(\tau)$ is increasing if $\alpha>1$, constant if $\alpha=1$, and decreasing if $\alpha<1$. The case of $\alpha>1$ is known as positive duration dependence, and the case of $\alpha<1$ as negative duration dependence. Positive (negative) duration dependence means it becomes more and more (less and less) likely that the duration will end as time progresses. The estimation problem involves determination of the scale parameter α and the coefficient vector β. The estimation procedure is explained in detail in the next section.

Empirical Testing and Results

To test the effect of the brokerage factors on TOM, we collected a sample of single-family home sales in State College, Pennsylvania. State College is a college town with a population of approximately 45,000. The sample contains 388 house sales in calendar year 1991. The sample comes from the multiple listing service, and almost all the agents use this service. There were nineteen real estate brokerage firms, whose size range from one agent to sixty-seven agents. For the house sales in our sample, three of the firms participated in listings only, four of them participated in sales only, and twelve of them participated in both listings and sales. The two largest firms enjoyed higher market share. The largest brokerage firm maintained 31% of the listings and 30% of the sales. The second largest brokerage firm accounted for 22% of the listings and 20% of the sales. Each of the next four largest firms enjoyed less than 10% of the listings and sales.

The descriptive statistics of the variables utilized in the test are provided in Exhibit 1. Brokerage factors investigated here are *SCOMMRT, LFSIZ, FIRM, LIST, SALE,* and *AGENT. SCOMMRT* is the sale commission rate offered by the listing agent to the selling agent in the MLS listing agreement. Despite its wide range, the standard deviation of *SCOMMRT* is very small (.16%). *LFSIZ* is the size of the listing firm, a numerical variable for the number of brokers and salespersons in each firm. *FIRM* is a dummy variable representing whether the sale is completed within a single firm; it is one if the property is both listed and sold by agents within a firm, and zero otherwise. Similarly, *AGENT* is the dummy variable taking the value of one if the property is both listed and sold by the same agent, and zero otherwise. *LIST* and *SALE* are two dummy variables measuring the performance of the listing agent. Specifically, *LIST* (*SALE*) is set to one if the listing agent's total number of listings (sales) in the given period is above its mean, and zero otherwise.

In addition to the above explanatory variables, three seasonal control variables are used in the model. *LSPRING, LSUMMER* and *LFALL* are dummy variables to indicate the quarter of the year the property is listed (January to March, April to June, and July to September, respectively). These listing season variables control for the "thickness" of the market. Both demand and supply in the housing market are associated with some seasonal effects. This is especially evident in a college town where migration affects the demand and supply of housing, thus exhibiting an identifiable seasonal pattern. Due to the potential simultaneity problem between the selling price and TOM, *SPHAT* (in 1,000 dollars) is computed as the predicted selling price in a hedonic equation based on physical attributes of housing.[6]

The duration model presented in this paper follows the specifications discussed previously in the section, *Duration Models*. The survival and the hazard functions are estimated using the *LIFEREG* procedure in SAS. This procedure provides estimates of duration models with several distributions including the Weibull distribution. Different distributions, such as the exponential, log-normal, Weibull, and their likelihood ratio estimates are tested for the model. Weibull distributions with scale parameter of α=.68 offer the best log likelihood ratio estimates. This value of α supports the hypothesis that linear and log-linear models are not as efficient at approximating housing duration. We then estimate the β parameters, and compute *chi*-square tests and the probabilities for significance for each parameter. *Chi*-square tests are computed based on the given vector of variables and the equation $\chi^2_n=2\ (L(n)-L(0))$, where L(n) is the log likelihood of the specified models and L(0) is the log likelihood of the model with no explanatory variables. The results are reported in Exhibit 2. The duration model presented in this exhibit is significant at the 1% level. A plot of the survival probability as a function of TOM is provided in Appendix 2.

With the exceptions of Claims 3 and 4, our results support the theoretical predictions presented in section two. First, we find that *SCOMMRT* does not exhibit a significant effect on TOM.[7] This is consistent with Claim 1. It is also consistent with the results reported in Larsen and Park (1989) and Sirmans et al. (1991). The insignificant result of *SCOMMRT* indicates that the incentive offered in the sales commission rate is adequately adjusted for the degree of difficulty to sell the property. Direct measures of the brokerage search efforts are not available. However, we find a significantly positive

Exhibit 1
Descriptive Statistics of the Variables

	Variable	Mean	Std Dev.	Minimum	Maximum
Duration Model	*TOM*	176.3196	137.6381	1.0000	851.0000
	SP	105.4575	43.5521	40.8750	312.0000
	SPHAT	105.4575	39.1071	36.5019	247.7030
	SCOMMRT	2.7177	.1640	2.2500	3.1500
	LFSIZ	40.2268	20.1920	1.0000	68.0000
	FIRM	.3196	(dummy)	0	1
	AGENT	.1211	(dummy)	0	1
	LIST	.7129	(dummy)	0	1
	SALE	.5541	(dummy)	0	1
	LSPRING	.3067	(dummy)	0	1
	LSUMMER	.3273	(dummy)	0	1
	LFALL	.1753	(dummy)	0	1
Hedonic Model	*YRB*	1968	20.2452	1800	1991
	RMS	6.9845	1.6058	3.0000	12.0000
	BATH	1.9562	.6623	1.0000	4.5000
	GAR	1.2088	.7507	.0000	3.0000
	TAXES	1.2685	.5136	.1931	3.3193
	ELEC	.5412	(dummy)	0	1
	AC	.1108	(dummy)	0	1
	SEWER	.1778	(dummy)	0	1

Notes:

TOM: Number of days between listing and contract for sale is signed.
SP: Selling prices, in 1,000 dollars.
SCOMMRT: Sale agent's commission split, in percentage of the selling price.
LFSIZ: The size (the number of agents) of the listing brokerage firm.
FIRM: Dummy variable, equals 1 if the property is listed and sold by the same brokerage firm, equals 0 otherwise.
LIST: Dummy variable, equals 1 if the listing agent's total number of listings is above the average, equals 0 otherwise.
SALE: Dummy variable, equals 1 if the listing agent's total number of sales is above the average, equals 0 otherwise.
AGENT: Dummy variable, equals 1 if the property is listed and sold by the same agent, equals 0 otherwise.
SPHAT: The predicted value of the selling price (*SP*) obtained from the hedonic model specified in Appendix 1.
LSPRING: Dummy variable, equals 1 if the property is listed in January, February or March, equals 0 otherwise.
LSUMMER: Dummy variable, equals 1 if the property is listed in April, May or June, equals 0 otherwise.
LFALL: Dummy variable, equals 1 if the property is listed in July, August or September, equals 0 otherwise.
SMINT: Sale month interest rate for conventional mortgages.
MLVOL: Listing volume (or number of houses on market) of the month the property is listed.
BIGLOFF: Dummy variable, equals 1 if the property is listed by a big realtor's firm, equals 0 otherwise.
BIGSOFF: Dummy variable, equals 1 if the property is sold by a big realtor's firm, equals 0 otherwise.

YRB: Year the house was built.
RMS: Number of rooms the house has.
BATH: Number of bathrooms the house has.
GAR: Number of cars the garage holds.
TAXES: Property taxes paid for the property each year, in 1,000 dollars.
ELEC: Dummy variable, equals 1 if the heating is electric, equals 0 otherwise.
AC: Dummy variable, equals 1 if the house has central AC, equals 0 otherwise.
SEWER: Dummy variable, equals 1 if it's public sewer, equals 0 otherwise.

Exhibit 2
Results from the Duration Model

Variable	Estimate	Std Error	χ^2	p-Value
INTERCPT	3.4723	.6651	27.2537	.0001
SCOMMRT	.3185	.2257	1.9914	.1582
LFSIZ	−.0003	.0018	.0254	.8733
FIRM	.0734	.0929	.6252	.4291
LIST	.1619	.0944	2.9384	.0865
SALE	−.1641	.0828	3.9211	.0477
AGENT	.0445	.1273	.1221	.7267
SPHAT	.0025	.0008	7.9902	.0047
LSPRING	.2849	.1027	7.6865	.0056
LSUMMER	.2765	.1006	7.5507	.0060
LFALL	.2745	.1153	5.6620	.0173

Dependent Variable=TOM
SCALE=.6833
Log Likelihood=−444.5641
Number of Noncensored Values=388

relationship between the predicted selling price, *SPHAT*, and TOM. That is, the properties that generate higher commissions take longer to sell. These two results imply that the difficulty level to sell varies among properties and the differences are adjusted for in the brokerage compensation.

Second, the firm-related variables, *LFSIZ* and *FIRM*, do not display significant effects on TOM either. The insignificance of *LFSIZ* supports Claim 2 by indicating that on average, houses listed with a larger firm stay on the market as long as those listed with a smaller firm. The existence of an MLS removes the potentially positive scale effects associated with a large firm. This finding is different from that of Larsen and Park (1989) and Sirmans et al. (1991). The firm size variable has a significantly negative impact on TOM in these two studies. Sirmans et al. (1991) provide the following argument for their result. Listing firms have incentives to cheat and to delay the reporting of new listings to the MLS. This makes it more attractive for buyers to go to large firms. As a result, the role of MLS in eliminating the "scale effects" discussed in Claim 2 could be significantly reduced. Our finding suggests that the impact of such practices by firms is not significant in our sample.

The insignificance of the *FIRM* variable contradicts Claim 3. Interestingly, a similar result is also reported in Sirmans et al. (1991). This leads us to conclude that the incentives offered by a firm to its agents to expend more efforts to sell firm-listed properties are not big enough to induce a significant impact.

Our results regarding the listing agent, *LIST* and *SALE*, are consistent with the theoretical predictions of Claims 5 and 6. The positive effect of *LIST* is associated with the reduced attention a listing agent can pay to each listing when her total number of listings increases. The negative parameter of *SALE* demonstrates the effectiveness of listing the property with a successful sales agent.

The final brokerage variable, *AGENT*, does not show a significant effect on TOM; the properties listed and sold by the same agent are not observed as having shorter duration. This is inconsistent with Claim 4. However, as pointed out in Note 4, there exists an opportunity cost for the extra time the agent spends on her own listings. The coefficient of *AGENT* variable indicates that this opportunity cost is high enough so that the agent treats listing and selling as separate activities.

Finally, the coefficients for all three season variables are significantly positive. Listing a property in the winter reduces TOM. Although spring and summer are viewed as seasons when the housing market is more active, it should be kept in mind that the average TOM in our sample is 176 days.

Concluding Remarks

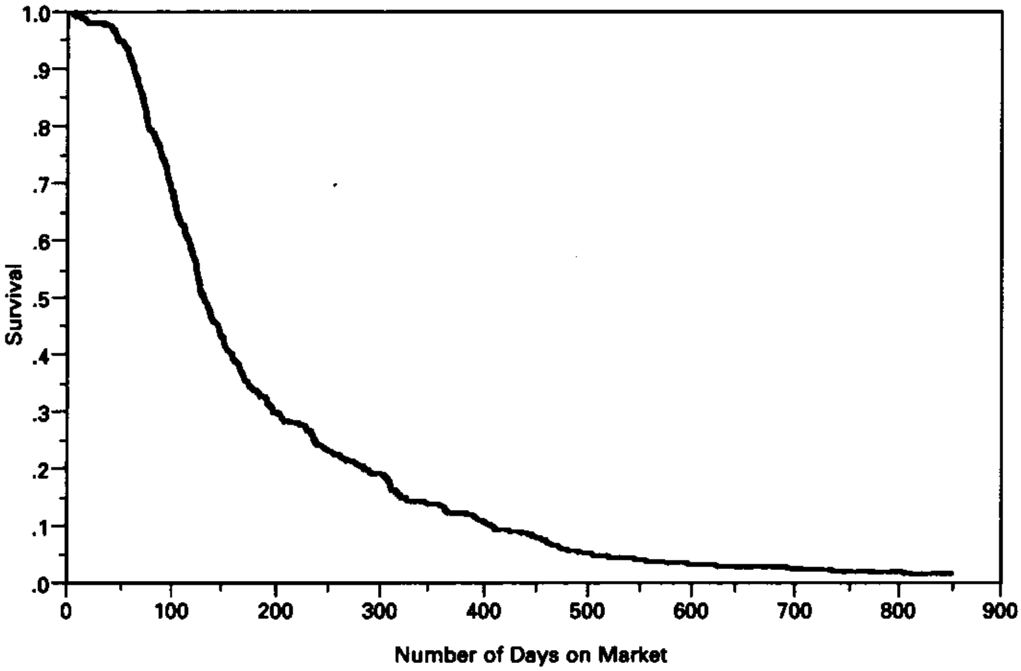
We use a duration model to examine how certain brokerage variables affect the time it takes to sell a residential property. We focus on the brokerage variables related to the listing agent and the listing brokerage firm. These are the brokerage variables that sellers can identify at the time of listing (the identity of the selling agent/firm is not known until the house is sold). Consequently, our results can be utilized by sellers at the listing stage of the game. Our results can also be useful to brokers in determination of optimal brokerage firm size. However, by no means do they capture all the significant elements of an optimal listing strategy and optimal firm size. It is hoped that this study will provide a better judgment of the theoretical predictions about brokerage services, and help to further our understanding of the brokerage industry.

Appendix 1
Results from the Hedonic Model

Variable	Estimate	Std Error	*t*-Statistic	*p*-Value
INTERCPT	583.0117	116.5075	5.004	.0001
YRB	−.3045	.0594	−5.124	.0001
RMS	2.9920	.8795	3.402	.0007
BATH	6.7319	2.0844	3.230	.0013
GAR	3.6799	1.6466	2.235	.0260
ELEC	6.8006	2.3733	2.865	.0044
AC	9.2893	3.3634	2.762	.0060
TAXES	59.9335	3.1019	19.321	.0001
SEWER	15.1874	2.6426	5.747	.0001

Dependent Variable = *SP*
Number of Observations = 388
R^2 = .8063, Adjusted R^2 = .8022

Appendix 2
The Survival Function of TOM



Notes

[1]For the purpose of clarifying the presentation, sellers and buyers will be portrayed as males and real estate brokers and agents as females.

[2]This signalling role of the commission rate has been indicated to us in our conversations with some real estate agents.

[3]The transaction costs here refer to the time and effort that is involved in the communication process before and during the closing stage between the listing agent and the selling agent. We were informed about such incentive practices by a local broker.

[4]It should be added that the listing agent also faces an opportunity cost for spending more effort on her own listings; as an agent spends more effort on her own listings, she has a smaller chance of selling other agents' listings and sharing the commission on those listings. Claim 4 is based on the assumption that this opportunity cost is not as high as the benefits from spending more time on one's own listings.

[5]This argument forms the basis of the theoretical model by Schroeter (1987). Note that Claim 4, as in the case of Claim 2, relies on the fact that in the presence of an MLS a larger listing pool by an agent does not necessarily attract a larger number of buyers to that agent.

[6]Earlier studies (e.g., Miller, 1978) indicate that the selling price can depend on how long the property was on the market prior to the sale. Thus, there is a potential simultaneity problem between TOM and selling price. To resolve this problem, we calculate the predicted sale price of each property in our sample (the results from the hedonic model are provided in Appendix 1) and use this predicted sale price in our duration model.

[7]We also did our analysis using the ex-post (actual) commission amount and the ex-ante commission amount (the *listing price* times the commission rate) rather than the commission rate. This did not change any of our results.

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We thank Beverly Morgan for helpful discussions.