Bargaining over Residential Real Estate: Evidence from England*

François Ortalo-Magné†
London School of Economics, STICERD and CEPR

Antonio Merlo‡
University of Pennsylvania, and CEPR

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Abstract

This paper presents and investigates a new data set of individual residential property transactions in England. The main novelty of the data is the record of all listing price changes and all offers ever made on a property since it appears on the market, as well as all the visits by potential buyers for a subset of the sample. We analyze individual seller and potential buyers behavior within property transaction histories. This leads us to establish a number of stylized facts pertaining specifically to the timing and terms of agreement in housing transactions, and more generally, to the sequence of events that occur from initial listing to sale agreement.

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†Department of Economics, London School of Economics, Houghton Street, London WC2A 2AE, UK; tel.: (44) 207 955 7559; email: francois@econ.lse.ac.uk

‡Department of Economics, University of Pennsylvania, 3718 Locust Walk, Philadelphia, PA 19104, USA; email: merloa@econ.upenn.edu

1 Introduction

The sale of a house is a classic example of a situation that entails strategic interactions between a seller and a set of potential buyers. When a house is put on the market, the seller posts a listing price and waits for potential buyers to make offers. When a match between the seller and a potential buyer occurs, bargaining takes place, leading possibly to a sale agreement. At any point in time while a house is still on the market, the seller has the option of revising the listing price.

To date, the lack of adequate data has severely limited the scope of empirical research on housing transactions. Existing data sets typically include property characteristics, time to sale, initial listing price, and sale price. They do not contain information on the buyer's side of the transaction (e.g., the timing and terms of offers made by potential buyers), or on the seller's behavior between the listing and the sale of a property (e.g., the seller's decision to reject an offer or to revise the listing price). The lack of empirical evidence has also constrained the development of theoretical research on the strategic interaction between buyers and sellers in the housing market.

This paper presents and investigates a new data set of individual residential property transactions in England. The main features of our data are the record of all listing price changes and all offers ever made on a property since initial listing. In addition, we have a complete record of viewings, for a subset of transactions in our sample. That is, we observe the sequence of all visits by potential buyers. We are therefore in a unique position to analyze the behavior of buyers and sellers within individual transaction histories. Our analysis generates a number of stylized facts pertaining specifically to the timing and terms of agreement in housing transactions, and more generally, to the entire sequence of events that occur from initial listing to sale agreement.

The picture of the house buying process which emerges from the data can be summarized as follows. The listing price influences the arrival rate of viewings which in turn affects the arrival rate of offers, which ultimately determines the timing of the sale. As time on the market increases, the arrival rate of viewings decreases and the probability of a listing price revision increases, especially if no offers have been received. The longer the time the property remains on the market, the lower the level of offers relative to the listing price, the higher the probability a seller accepts a first offer, and the lower the sale price relative to the listing price.

A high initial listing price results in fewer viewings, higher offers and a higher sale price but a longer time on the market. Listing price decreases concern primarily properties

which have not received any offer while being on the market for a substantial period of time (in fact, a period equal to the average time to sale). Proportionally, decreases in listing price are greater than the average percentage difference between the sale price and the initial listing price.

More than a third of sales occur at the first offer ever received. A third of buyers whose first offer is turned down walk away from the negotiation. A third of all matches are unsuccessful. The large majority of sellers who turn down the first bidder end up selling at a higher price. These are a few of the salient features observed in the data. A full summary is proposed in Section 5.

The remainder of the paper is organized as follow. After a brief review of the literature in Section 2, Section 3 describes our data set and provides institutional details of the residential real estate market in England. Section 4 reports the results of our empirical analysis of the process leading to the sale of a property, from its initial listing to a sale agreement. Sections 5 summarizes our main findings and interprets them in the context of the existing literature. Section 6 offers some conclusions.

2 Relevant Literature

A vast empirical literature focuses on the estimation of hedonic equations to predict the sale price of a house as a function of its characteristics. This approach ignores the strategic interaction between buyers and sellers by implicitly assuming that the housing market is perfectly competitive. Therefore, it has no predictive power relative to the listing price, the offer distribution, and the time to sale. Partial attempts to address these issues include Horowitz (1992), and Genesove and Mayer (1997).

Horowitz estimates a structural model of the seller's behavior which generates predictions for the sale price and the time to sale of a house, conditional on its characteristics and its listing price. Besides overcoming some of the limitations of the hedonic price regressions, his approach also considerably improves upon the accuracy of price predictions. The drawback of Horowitz's framework, however, is that it abstracts from modeling the behavior of the potential buyers. As a consequence, his analysis is incapable of fitting the offer distribution and generates a poor prediction of the time it takes to sell a property.

Genesove and Mayer (1997) build a data set for the Boston condominium market where they are able to uncover the financial position of each seller. They find that

sellers with high loan-to-value ratio tend to set a higher initial listing price, have a lower probability of sale but, if and when they sell, obtain a higher price.

These two studies point to the listing price as a significant determinant of the sale price and the timing of the transaction. Similar evidence is reported in Springer (1996), Knight et al. (1998), and Glower et al. (1998). Typically in the existing literature, the choice of listing price is assumed to result from the seller's optimization in face of a tradeoff between expected time to sale and sale price: a low listing price increases the arrival rate of potential buyers but precludes the possibility of sales at a high price (e.g. Yavaş (1992), Yavaş and Yuang (1995), Haurin (1988) and Arnold (1999)).

Chen and Rosenthal (1996a, 1996b) provide a theoretical foundation for this view of the listing price. They argue the listing price is a commitment device for the seller who provides incentives for potential buyers to incur search costs in order to learn their own willingness to pay for the property. They model the seller's problem as stationary, hence there is no scope for any listing price change.

The theoretical work of Coles (1998) on stock-flow matching provides a model with predictions concerning the optimal listing price strategy over time. A new seller first faces the existing stock of potential buyers who have not found anything to their liking on the market. Hence she does not face any competition from the current stock of sellers who have had their property on the market for a while. If they had a property to the liking of any potential buyer, they would have sold it. In this context, a Dutch auction allows the new seller to extract the best price from any existing potential buyer who has a high enough value of her property. If none of them buy the property, the seller remains on the market and compete with the existing stock of sellers to attract any incoming potential buyers. Coles shows that it is then optimal for the seller to continuously decrease her listing price as time goes by.

The optimal listing price behavior depends critically on the information it carries and how buyers internalize this information; i.e., what happens once a seller and a buyer are matched. Prior to our study, no data was available to inform the theory on the bargaining element of the transactions, an element overlooked so far. Our data provides the missing information and opens new avenues for further theoretical contributions.

3 The Data

In England, most residential properties are marketed under sole agency agreement. This means that a property is listed with a single real estate agency that coordinates all market related activities concerning that property from the time it is listed until it either sells or is withdrawn.

Agencies represent the seller only. Listing a property with an agency entails publishing a sheet of property characteristics and a listing price. The listing price may be revised at any time at the discretion of the seller. Potential buyers search by visiting local real estate agents and viewing properties. A match between the seller and a potential buyer occurs when the potential buyer makes an offer. Within a match, the general practice is for the seller to either accept or reject offers. In the event the seller rejects an offer, the potential buyer either makes another offer or walks away. If agreement occurs, both parties engage the administrative procedure leading to the exchange of contracts and the completion of the transaction. This procedure typically lasts three to eight weeks. During this period, among other things, the buyer applies for mortgage and has the property surveyed. Each party may cancel the sale agreement up to the exchange of contracts.

For each property it represents, the agency keeps a file containing a detailed description of the property, its listing price, and a record of listing price changes, offers, and terms of the sale agreement, as required by law. The information contained in each individual file is also recorded on the accounting register that is used by each agency to report to the head office. Although all visits of a property by potential buyers are arranged by the listing agency, recording viewings is not required either by the head office or by law. However, individual agencies may require their agents to collect this information for internal management purposes.

Our data set was obtained from the records of four real estate agencies in England.[1] Three of these agencies operate in the Greater London metropolitan area, one in South Yorkshire. Our sample consists of 780 complete transaction histories of properties listed and sold between June 1995 and April 1998 under sole agency agreement.[2] Each observation contains the property's characteristics as shown on the information sheet published by the agency at the time of initial listing, the listing price and the date of the listing.

[1] These agencies are all part of Halifax Estate Agencies Limited, one of the largest network of real estate agents in England.

[2] Each entry in our data was validated by checking the consistency of the records in the accounting register and in the individual files. Observations with inconsistent or incomplete records were dropped.

If any listing price change occurs, we observe its date and the new price. Each match is described by the date of the first offer by a potential buyer and the sequence of buyer's offers within the match. When a match is successful, we observe the sale agreed price and the date of agreement which terminate the history. In addition, for the properties listed with one of our Greater London agencies (which account for about a fourth of the observations in our sample), we observe the complete history of viewings. Since events are typically recorded by agents within the week of their occurrence, we use the week as our unit of measure of time.

Our data spans two geographic areas with different local economic conditions and two different phases of the cycle in the housing market. While the local economy in Greater London has been experiencing a prolonged period of sustained growth, this has not been the case in South Yorkshire. Furthermore, from June 1995 to April 1998, the housing market in the Greater London metropolitan area went from a slow recovery to a boom. While this transition occurred gradually, for ease of exposition we refer to 1995-96 as the recovery and to 1997-98 as the boom.

Table 1 contains an overview of some of the features of our data. Column 1 refers to the properties in our sample located in South Yorkshire. Columns 2 and 3 refer to properties located in Greater London that were listed during the recovery and the boom, respectively. Column 4 refers to the overall sample.

Table 1: Overview

	Yorkshire 95-98	London 95-96	London 97-98	Overall 95-98
Number of observations	343	239	198	780
Average initial listing price	£40,665	£86,783	£99,820	£69,812
Transactions with a price change	35.28%	17.99%	8.59%	23.21%
Average number of matches	1.26	1.62	1.53	1.44
Average number of offers	1.73	2.91	2.38	2.26
Average sale price	£37,989	£83,524	£97,168	£66,964
Sale price/listing price	93.4%	96.2%	97.3%	95.9%
Average weeks to sale	15	10	7	11

Several observations are noteworthy. First, more active housing markets (e.g., Greater London *vs.* South Yorkshire) appear to be characterized by higher sale price relative to listing price, fewer listing price changes, more offers, and more matches. Most of these observations hold true when we compare booming markets to dull markets (e.g., Greater London in 1997-98 *vs.* 1995-96). Overall, properties in our sample, on average, sell at about 96% of their listing price after being on the market for 11 weeks. More than three

quarters of all properties sell without any revision of their listing price. The average number of matches and the average number of offers indicate that most properties are sold to the first potential buyer who makes an offer on the property, but not necessarily at their first offer. In addition to the information reported in Table 1, note that for the sub-sample of 199 properties for which viewings records are available, the average number of viewings per property is equal to 9.5 and the average number of viewings per week on the market is equal to 1.7.

Table 2 contains descriptive statistics of the main characteristics of the properties in our sample.[3] The variables FLAT, TERR, SEMI, and DET are dummy variables for the type of property. They denote flats, terraced, semi-detached, and detached properties, respectively. The variables B1, B2, B3, and B4 are dummy variables which stand for one, two, three, and four or more bedrooms, respectively. GARAGE indicates whether the property has a garage. TOTA is the total area measured in square meters, NBATH is the number of bathrooms, and APPL is the number of appliances listed on the characteristic sheet published by the agent.[4] As we can see from column 7, most properties in our sample have either two or three bedrooms (77 percent). Semi-detached properties are the most represented (38 percent). Terraced properties, detached houses, and flats, account for 27, 15, and 20 percent of the sample, respectively. The remainder of the table illustrates the type of housing available in each of the local markets we consider.

Before turning our attention to the analysis of the data, a few remarks are in order. First, our data refers to complete transaction histories only, from initial listing to sale agreement. In particular, properties that are listed and then withdrawn from the market before a sale agreement are not in our sample. For this reason, the emphasis of the paper is on the events leading to the sale of a property and on the behavior of buyers and sellers during this process.[5]

Second, the cancellation of a sale agreement is not a rare phenomenon. In our sample, 1 out of 5 agreements is cancelled. Agents' records indicate that cancellations are usually due to the arrival of new information such as a bad survey or failure to obtain mortgage. A sale agreement may also be contingent upon the successful completion of other transactions (e.g., the purchase of a house by the seller). Hence, cancellations may

[3]These characteristics are only a subset of the ones listed in the information sheet published by the agency at the time of initial listing. The additional variables were excluded from our analysis since they appear to have no effect on prices.

[4]Agents typically list the major appliances to be left with the property. The number of such appliances was the only information recorded in the data set.

[5]Withdrawals are not infrequent. Based on a preliminary investigation we estimate that as many as 25 percent of all listings may end up being withdrawn prior to a sale.

Table 2: Property characteristics

	Yorkshire 97-98		London 95-96		London 97-98		Overall 95-98	
Variable	Avg	Std Dev	Avg	Std Dev	Avg	Std Dev	Avg	Std Dev
FLAT	0.026	0.16	0.264	0.442	0.439	0.498	0.204	0.403
TERR	0.318	0.466	0.222	0.416	0.263	0.441	0.274	0.446
SEMI	0.464	0.499	0.389	0.489	0.202	0.403	0.375	0.484
DET	0.192	0.395	0.125	0.332	0.096	0.295	0.147	0.355
TOTA	66.1	17.5	59	22.1	53.93	18.07	60.8	19.8
NBATH	1.24	0.576	1.42	0.615	1.29	0.519	1.31	0.579
GARAGE	0.426	0.495	0.377	0.486	0.263	0.441	0.369	0.483
APPL	0.793	1.19	1.25	1.5	0.949	1.17	0.973	1.306
B1	0.006	0.076	0.184	0.388	0.263	0.441	0.126	0.332
B2	0.306	0.462	0.31	0.463	0.323	0.469	0.312	0.463
B3	0.592	0.492	0.364	0.482	0.353	0.479	0.461	0.499
B4	0.096	0.295	0.142	0.35	0.061	0.239	0.101	0.302

also be induced by the failure of related transactions. Here we implicitly assume that parties bargain in earnest. That is, we assume that the right to cancel a sale agreement does not distort the behavior of the parties involved in a housing transaction and that the object of a negotiation is the sale of a house.

4 Empirical Analysis

In this section, we analyze the details of the process leading to the sale of a property, from its initial listing to a sale agreement. The first step in this process is the setting of the listing price on the part of the seller. In section 4.1, we analyze the choice of the initial listing price and whether, when, and to what extent sellers revise their decision. The next step is the occurrence of matches between the seller and the potential buyers who choose to make offers on a property. In section 4.2, we analyze when matches occur and the behavior of the seller and the potential buyers who engage in the bargaining process leading either to a sale agreement or to a voluntary separation. The final step is the sale of a property. In section 4.3, we analyze the timing and terms of the sale agreement. Finally, restricting attention to the sub-sample of properties for which information on viewings is available, we analyze the role played by viewings in the process leading to the sale of a property in section 4.4.

To investigate the effects of local market conditions on transaction histories, throughout our analysis we use agency-specific dummy variables, labeled AGENCY1, AGENCY2, AGENCY3, and AGENCY4, where AGENCYi is equal to 1 if the property is located in the local market where agency i operates and 0 otherwise ($i = 1, 2, 3, 4$). Note that agencies 1, 2, and 3 list properties located in different communities within the Greater London metropolitan area, while agency 4 operates in South Yorkshire. Furthermore, to account for aggregate dynamics in the English housing market, we specify a linear trend for the month in our sampling period when each property was listed, MONTH, and an additional linear trend for the properties located in Greater London, MONTHGL.

4.1 Listing Price

What determines the initial listing price of a property? To what extent is this price related to the property's observable characteristics? We begin our analysis by investigating the relation between individual property characteristics and initial listing price using the standard hedonic framework. The results of a regression of the initial listing price (ILISTP) on the property characteristics, agency dummies, and the trend variables MONTH and MONTHGL are reported in Table 3. Standard errors are in parentheses.[6] Note that the default property is a one bedroom semi-detached house located in South Yorkshire (i.e., the local market where agency 4 operates).

All of the parameter estimates associated with the property characteristics included in the hedonic regression are statistically significant at conventional levels and have the expected sign and reasonable magnitudes.[7] The estimated coefficients of the agency dummies and the time trend for Greater London indicate that, after controlling for property characteristics, more active housing markets and booming markets are associated with higher listing prices.

The variables included in our regression jointly account for 80 percent of the observed variability in the initial listing price. This level of explanatory power is comparable to what is typically found in the literature on hedonic models of housing prices.[8] Overall, the choice of initial listing prices by sellers depends to a large extent on the observable

[6] In this table as for all other estimations below, we only report whether each parameter estimate is significantly different from zero at the 5 percent level. We indicate this occurrence with the superscript *.

[7] Given the size of its estimated coefficient, the variable APPL must be capturing more than the monetary value of what it accounts for.

[8] Recent work which incorporates variables accounting for the details of all local public amenities generates higher values for the regression's R^2 (e.g. Cheshire and Sheppard. These details are not available in our data.

Table 3: Initial listing price hedonics

FLAT	−16687*
	(2932)
TERR	−7486*
	(1762)
DET	20787*
	(2287)
TOTA	522*
	(56)
NBATH	6256*
	(1384)
GARAGE	6377*
	(1609)
APPL	3801*
	(532)
B2	14380*
	(2490)
B3	11748*
	(2945)
B4	19205*
	(4510)
AGENCY1	24997*
	(3694)
AGENCY2	58303*
	(4107)
AGENCY3	46357*
	(3652)
MONTH	158
	(117)
MONTHGL	861*
	(159)
INTERCEPT	−24739*
	(4097)
R^2	.80

characteristics of their properties. Our specification of the hedonic model, however, cannot fully account for the variability in initial listing prices.

The first novelty of our data set is the information on listing price changes, which is summarized in Table 4 below.[9] As we can see from this table, about a fourth of all sellers change their listing price at least once.[10] Before a first price change, they wait 11 weeks on average. Recall from Table 1 above that the average time to sale is also 11 weeks. This observation suggests that sellers who change their listing price wait a significant amount of time before doing it. The price drop is also substantial. It is equal to 5.3 percent on average, which is greater than the average sale price discount relative to initial listing price (4.1 percent). In the vast majority of cases, sellers who decrease their listing price have no prior response from prospective buyers: in 86 percent of the cases, price changes occur before an offer was ever received.

Table 4: Listing Price Changes

	Yorshire 95-98	London 95-96	London 97-98	Overall 95-98
Price change distribution:				
Percent pties with 0	65	82	91	77
Percent pties with 1	26	14	8	18
Percent pties with 2+	9	4	1	5
First price change:				
Average percent price decrease	6.3	3.4	2.6	5.3
Average weeks since listing	12	10	9	11
Percent pties with no offer yet	92	71	80	86
Second price change:				
Average percent price decrease	4.8	2.6	-	4.4
Average weeks since first price change	9	7	-	8
Percent pties with no offer yet	72	67	-	70

Looking at differences across local markets, columns 1-3 in Table 4 illustrate that in more active markets and in booming markets price changes are less frequent and, when they occur, they entail a smaller reduction of the listing price.

What prompts sellers to revise their listing price? When do they revise it? Does it have anything to do with whether or not they receive an offer? To explore these issues

[9]The overwhelming majority of price changes were price decreases. Of the three cases of listing price increases, one is minor, less than one percent. The other two are more substantial: one is an adjustment within a few days of initial listing, the other occurs three months after initial listing, reflecting possibly home improvements.

[10]Note that only 9 transactions involved 3 listing price changes, the maximum observed in our sample.

further, we estimate a flexible functional form hazard (Flinn and Heckman, 1982) for the probability a seller would revise the listing price in any given week after putting his property on the market.[11] The flexible functional form for the hazard function we consider here is given by:

$$P(ELISTP_t \neq ILISTP | ELISTP_{t-1} = ILISTP) = e^{\beta_0+\beta_1 t+\beta_2 t^2+\beta_3 t^3+\beta_4 X_{1,t}+\beta_5 X_2}, \quad (1)$$

where t denotes weeks since initial listing, $ELISTP_t$ the effective listing price at time t, X_2 the vector of time-invariant covariates, and $X_{1,t}$ the vector of time-varying covariates.[12] In particular, the set of time-invariant variables we consider includes property characteristics, agency dummies, MONTH, MONTHGL, and the initial listing price (ILISTP). Our specification also includes a time-varying variable denoting the highest offer received each week as a proportion of the effective listing price (HOELISTP). HOELISTP is set to zero when no offer was received and thus captures both whether or not an offer was received and the relative level of this offer.

As reported on Table 5, all terms of the cubic specification of the baseline hazard are significant displaying the following non-monotonic pattern: the probability of a price revision increases first up to 15 weeks, it then decreases until week 47 before rising again.[13] Receiving a high offer decreases the probability of a price change. A high initial listing price also decreases the probability of a listing price change. Price changes are more likely in the later part of our sampling period as indicated by the positive coefficient associated with the variable MONTH. However, the probability of a price change decreases in a booming market, as indicated by the negative sign of the coefficient associated with MONTHGL and by the fact that this effect dominates the positive effect of MONTH.

When a seller decides to revise the listing price, what factors affect the size of the price drop? To address this question, we run a regression of the percentage change in the listing price on property characteristics, agency dummies, MONTH, MONTHGL, initial listing price, number of weeks between listing and price change (WTFPC), and a dummy variable equal to one if no offers were made on the property (NOOFF). The results are reported in Table 6.

As we can see from this table, the longer sellers wait to change the listing price, the larger the drop. Also, the higher the initial listing price, the smaller the listing price

[11] This approach consists of approximating the baseline hazard function with a polynomial function in time, where the order of the polynomial function is chosen to best fit the data.

[12] Since not all sellers revise their listing price, some observations are censored. We correct for censoring in the estimation which is carried out by maximum likelihood.

[13] Likelihood ratio tests reject higher-order polynomial specifications in favor of the cubic specification reported here.

Table 5: Time to first price change hazard estimation

Variable	Estimate
FLAT	0.034
	(0.396)
TERR	0.221
	(0.210)
DET	0.267
	(0.269)
TOTA	0.147
	(0.648)
NBATH	−0.251
	(0.178)
GARAGE	0.103
	(0.194)
APPL	0.010
	(0.067)
B2	0.353
	(0.340)
B3	0.175
	(0.385)
B4	0.633
	(0.520)
AGENCY1	1.371*
	(0.443)
AGENCY2	0.922
	(0.573)
AGENCY3	0.724
	(0.482)
MONTH $\times 10^{-2}$	3.758*
	(1.010)
MONTHGL $\times 10^{-2}$	−4.407*
	(1.972)
ILISTP $\times 10^{-5}$	−1.262*
	(0.539)
HOELISTP	−0.772*
	(0.343)
T $\times 10^{-1}$	3.154*
	(0.462)
$T^2 \times 10^{-2}$	−1.415*
	(0.235)
$T^3 \times 10^{-4}$	1.532*
	(0.274)
INTERCEPT	−5.047*
	(0.527)

Table 6: Size of listing price drop

FLAT	1.968
	(1.415)
TERR	2.086*
	(0.809)
DET	0.693
	(1.148)
TOTA	.036
	(.025)
NBATH	2.307*
	(0.641)
GARAGE	−0.277
	(0.774)
APPL	−0.398
	(0.293)
B2	−0.654
	(1.369)
B3	−0.230
	(1.491)
B4	−0.454
	(2.144)
AGENCY1	−0.440
	(1.841)
AGENCY2	0.141
	(2.182)
AGENCY3	−0.312
	(2.102)
MONTH	0.036
	(0.050)
MONTHGL	−0.035
	(0.082)
WTFPC	0.113*
	(0.042)
ILISTP $\times 10^{-}4$	−0.519*
	(0.223)
NOOFF	0.121
	(0.932)
INTERCEPT	1.237
	(2.289)
R^2	.32

revision in percentage terms. The lack of offers does not seem to have any effect on the magnitude of listing price changes.

4.2 Matches and Offers

The second novelty of our data set concerns the record of all matches that occur between each seller in our sample and the potential buyers who choose to make offers on his property. This information is summarized in Table 7 below. Approximately 72 percent of all transactions occur within the first match. Only 10 percent of all sales occur after 3 or more matches.[14] About a third of all matches are not successful. On average, the success rate of first matches is higher than that of later matches. About three quarters of the sellers are matched with a potential buyer within ten weeks of putting their property on the market. More than ten percent within one week.

Table 7: Matches

	Yorshire 95-98	London 95-96	London 97-98	Overall 95-98
Matches per sale:				
Average	1.2	1.6	1.5	1.4
Percent pties with 1	79	64	68.1	71.7
Percent pties with 2	17.2	20.9	17.7	18.4
Percent pties with 3	2.6	8	9.1	5.9
Percent pties with 4+	1.2	7.1	5.1	3.9
Time to first match (weeks)				
Average	12	7	5	9
Median	8	5	3	5
Percent with match within 1 week	3.5	16.3	16.7	12.6
Percent with match within 10 weeks	61.2	80.3	87.4	73.7
Success rate:				
All matches	79.4	61.6	65.6	69.5
First match	81.6	66.5	72.2	74.6
Second match	70.8	58.1	54.0	61.1
Third match	69.2	47.2	50.0	51.9

Looking at differences across local markets, columns 1-3 in Table 7 illustrate that more active markets and booming markets are characterized by greater turnover. Matches occur sooner, they are more frequent, and their success rate is lower.

[14]Note that only 10 transactions occur after 5 or more matches and the maximum number of matches in the sample is 7.

Figure 1 plots the average number of matches per week for all properties still on the market. This measure of the rate of arrival of matches increases from the first to the second week. Following this rise, the rate of arrival gradually decreases up to 21 weeks, before rising again.

What affects the rate of arrival of matches? How do time on the market and listing price influence the probability of a match occurring? To address these questions we estimate a flexible functional form hazard (similar to the one above) for the probability a match would occur in any given week since the listing of a property on the market. The set of time-invariant variables we consider includes property characteristics, agency dummies, MONTH, and MONTHGL. Our specification also includes two time-varying variables denoting the effective listing price (ELISTP) and the occurrence of listing price changes (DPC), respectively.[15]

The maximum likelihood estimates and standard errors we obtain are reported in Table 8. All terms of the quadratic specification of the baseline hazard are significant displaying the following non-monotonic pattern: the probability of arrival of the first match decreases first up to 23 weeks since initial listing and then increases.[16] A listing price revision increases the probability of arrival of the first match, but the level of the listing price has no effect on this probability. Also, more active markets are associated with a higher probability of arrival of the first match.

When a match occurs, the seller and the potential buyer engage in a bilateral bargaining process characterized by a sequence of buyer's offers that the seller either accepts or rejects. Our data set contains detailed information on all offers ever made on a property, which is summarized in Tables 9, 10, and 11 below.

Table 9 summarizes the main properties of observed sequences of offers within matches. Potential buyers make up to four consecutive offers, increasing their offers at a decreasing rate. In more than half of the matches only one offer is exchanged. Almost 40 percent of sales occur at the first offer ever received, 54 percent occur at the first offer of a match. Upon rejection of their first offer, 68 percent of all potential buyers make a second offer. The remaining 32 percent walk away, leading to a match breakdown or separation. The incidence of separations increases with the number of rejected offers. That is, the fraction of potential buyers who terminate a negotiation after having their first offer rejected is smaller than the fraction of potential buyers who do so after a second or third rejection.

[15]DPC is a time-varying indicator variable that takes the value 0 prior to a listing price change and 1 from the occurrence of a listing price change on.

[16]Likelihood ratio tests reject higher-order polynomial specifications in favor of the quadratic specification reported here.

Figure 1: Matches per property on the market, per week

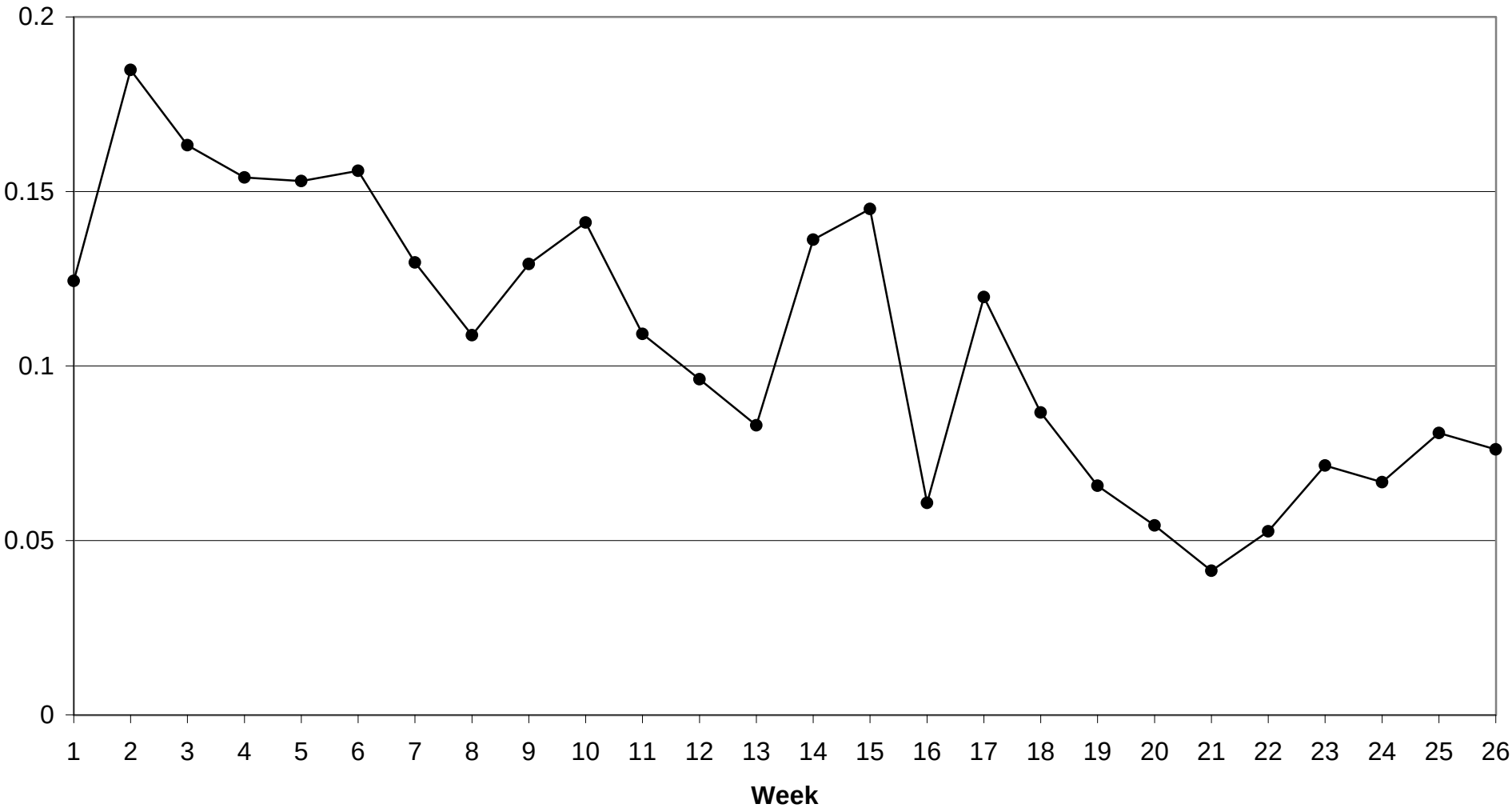

Table 8: Time to first match hazard estimation

Variable	Estimate
FLAT	-0.058
	(0.170)
TERR	0.087
	(0.099)
DET	-0.226
	(0.131)
TOTA$\times 10^{-2}$	0.399
	(0.306)
NBATH	0.056
	(0.076)
GARAGE	-0.024
	(0.092)
APPL	0.011
	(0.031)
B2	0.155
	(0.138)
B3	0.218
	(0.161)
B4	0.023
	(0.250)
AGENCY1	0.786*
	(0.206)
AGENCY2	0.606*
	(0.251)
AGENCY3	0.666*
	(0.222)
MONTH $\times 10^{-2}$	3.025*
	(0.615)
MONTHGL $\times 10^{-2}$	0.197
	(0.872)
ELISTP $\times 10^{-6}$	-1.417
	(2.097)
DPC	0.243*
	(0.104)
T $\times 10^{-2}$	-2.258*
	(1.065)
$T^2 \times 10^{-4}$	4.990*
	(2.343)
INTERCEPT	-3.392*
	(0.243)

Table 9: Offers

	Yorshire 95-98	London 95-96	London 97-98	Overall 95-98
Number of matches	432	388	302	1122
Distribution of offers per match:				
Average	1.37	1.79	1.56	1.57
Percent matches with 1	69.9	44.6	56.0	57.4
Percent matches with 2	23.4	34.5	33.1	29.9
Percent matches with 3	6.5	18.0	9.6	11.3
Percent matches with 4	0.2	2.8	1.3	1.4
First offer relative to listing price	92.4	94.3	95.6	94.0
Increments within match:				
First to second offer	5.22	2.64	2.33	3.26
Second to third offer	3.19	1.98	1.50	2.12
Percent separations				
After one unsuccessful offer	36.6	28.3	31.1	31.5
After two unsuccessful offers	31.0	34.1	50.0	38.1
After three unsuccessful offers	50.0	65.6	71.4	66.7

In Table 10, we restrict attention to offer sequences within a match that are not censored by agreement with the seller. That is, we restrict attention to unsuccessful matches or matches that terminate with a separation. As we can see from this table, the higher the number of offers in a match the lower the first offer relative to the listing price. In general, the higher the number of offers in a match, the higher the last offer relative to the effective listing price. It therefore appears that the more offers there are in a match, the broader the interval spanned by the offers.

Table 10: Spread of offers, unsuccessful matches

	Yorshire 95-98	London 95-96	London 97-98	Overall 95-98
2 offers in match				
First offer relative to listing price	85.0	93.5	93.2	92.1
Last offer relative to listing price	88.6	96.6	95.9	95.2
3 offers in match				
First offer relative to listing price	-	90.9	92.3	91.1
Last offer relative to listing price	-	95.6	95.9	96.1

As we can see from columns 1-3 in Tables 9 and 10, in more active markets we observe a larger volume of offers and offers that are on average closer to the listing price. Within offer sequences, however, we observe smaller increments.

In Table 11, we compare the first offer in a match across different matches within a transaction history. As we can see form this table, on average, the first offer relative to the listing price is increasing in the number of matches in a transaction history. In particular, both in the aggregate as well as in each local market, the first offer in the first match is on average farther away from the listing price than the first offer in successive matches.

Table 11: First offer relative to listing price

	Yorshire 95-98	London 95-96	London 97-98	Overall 95-98
First match	92.2	93.9	95.3	93.5
Second match	93.2	94.7	96.6	94.7
Third match	92.2	95.5	97.3	95.6
Fourth match	93.4	97.1	97.2	96.6

What affects the level of the first offer by a potential buyer which initiates a match? Do offers depend systematically on such factors as how long a property has been on the market and whether the seller previously engaged in negotiations that were unsuccessful? To answer these questions we regress the first offer in a match as a fraction of the effective listing price at the time of the match (PERMFOEL) on the property characteristics, agency dummies, MONTH, MONTHGL, the number of weeks between initial listing and the occurrence of the match (WTMATCH), and a dummy variable equal to one if the seller did not have any prior match and zero if the offer comes after one or more unsuccessful matches (MATCH1). The results are contained in Table 12 below.

As we can see from Table 12, *ceteris paribus*, the level of the first offer in a match relative to the listing price is lower the longer a property has been on the market and if it is the first offer ever made on a property. Also, after controlling for property characteristics, time on the market, and order of matches, potential buyers in more active housing markets initiate matches with offers that are closer to the effective listing price.

Once an offer is on the table and a seller is matched with a potential buyer, what determines the seller's decision as to whether to accept or reject the first offer in a match? Is this decision influenced in a systematic way by how long the property has been on the market and whether or not the seller is facing his very first match? To address these questions we define the variable ACCEPT as a binary variable that equals one if the seller accepts the first offer in a match and zero otherwise. The results of a logit estimation where ACCEPT is the dependent variable and the set of independent variables includes property characteristics, agency dummies, MONTH, MONTHGL, the number

Table 12: First offer as proportion of effective listing price

Variable	Estimate
FLAT	0.289
	(0.788)
TERR	-2.135^*
	(0.490)
DET	0.575
	(0.614)
TOTA$\times 10^{-3}$	.996
	(15.12)
NBATH	0.422
	(0.387)
GARAGE	0.577
	(0.437)
APPL	0.163
	(0.142)
B2	0.824
	(0.689)
B3	1.263
	(0.808)
B4	-0.631
	(1.196)
AGENCY1	2.112^*
	(1.059)
AGENCY2	-0.116
	(1.125)
AGENCY3	2.313^*
	(1.026)
MONTH	0.038
	(0.035)
MONTHGL	0.029
	(0.044)
WTMATCH	-0.076^*
	(0.020)
MATCH1	-1.317^*
	(0.406)
INTERCEPT	92.286^*
	(1.363)
R^2	.14

of weeks between initial listing and the occurrence of the match (WTMATCH), the first offer in the match as a fraction of the effective listing price at the time of the match (PERMFOEL), and the match indicator MATCH1, are reported in Table 13 below.

As we can see from Table 13, *ceteris paribus*, the probability of acceptance of the first offer in a match on the part of the seller is higher the longer a property has been on the market, the closer the offer is to the listing price, and whether it is the first offer ever received.[17] Also, after controlling for property characteristics, time on the market, and order of matches, sellers in more active housing markets are less likely to accept a given offer relative to listing price.

In the event their offer is rejected by the seller, potential buyers have to decide whether to make a second offer or terminate a match by walking away. We investigate the buyer's decision using a logit model with the same specification as the one we use to analyze the seller's acceptance decision. The results of our analysis, not reported here, indicate no systematic effects except for the fact that, *ceteris paribus*, the probability a potential buyer walks away after having his first offer rejected is lower in the first match than in successive matches.

The analysis of the level of successive offers within a match, the seller's acceptance decision, and the behavior of potential buyers' after a rejection, produces similar results to the ones reported above for the initial offer in a match. The details are therefore omitted.

We can now ask the following question: What differentiates successful matches form unsuccessful ones? In other words, are there observable factors that systematically influence the behavior of potential buyers and sellers when they bargain over a property and affect the relative probability that a match would result in a sale agreement instead of a separation? To address this question we define the variable SUCCESS as a binary variable that equals one if bargaining within a match leads to a sale agreement and zero if it terminates with a separation. The results of a logit estimation where SUCCESS is the dependent variable and the set of independent variables includes property characteristics, agency dummies, MONTH, MONTHGL, the number of weeks between initial listing and the occurrence of the match (WTMATCH), the maximum offer in the match as a fraction of the effective listing price at the time of the match (MAXOELP), the number of offers exchanged in the match (MNOFFER) and the match indicator MATCH1, are reported in Table 14 below.

[17]The coefficient associated with the variable MATCH1 is different from zero at the 6% significance level.

Table 13: Probability the seller accepts the first offer of a match

Variable	Estimate
FLAT	0.301
	(0.294)
TERR	0.334
	(0.186)
DET	-0.588^{*}
	(0.241)
TOTA$\times 10^{-3}$	0.898
	(5.745)
NBATH	-0.037
	(0.146)
GARAGE	-0.367^{*}
	(0.167)
APPL	-0.064
	(0.057)
B2	0.225
	(0.266)
B3	0.204
	(0.313)
B4	0.397
	(0.469)
AGENCY1	-1.754^{*}
	(0.401)
AGENCY2	-2.023^{*}
	(0.434)
AGENCY3	-2.164^{*}
	(0.401)
MONTH$\times 10^{-2}$	-0.417
	(1.320)
MONTHGL$\times 10^{-2}$	2.821
	(1.685)
WTMATCH$\times 10^{-2}$	1.959^{*}
	(0.765)
MATCH1	0.294
	(0.158)
PERMFOEL$\times 10^{-2}$	16.063^{*}
	(1.667)
INTERCEPT	-15.203^{*}
	(1.641)

Table 14: Probability of success of a match

Variable	Estimate
FLAT	0.163
	(0.309)
TERR	0.226
	(0.199)
DET	-0.205^{*}
	(0.238)
TOTA$\times 10^{-2}$	0.465
	(0.587)
NBATH	-0.140
	(0.145)
GARAGE	-0.321^{*}
	(0.171)
APPL	-0.022
	(0.055)
B2	-0.257
	(0.273)
B3	-0.308
	(0.318)
B4	-0.120
	(0.466)
AGENCY1	-1.371^{*}
	(0.450)
AGENCY2	-1.801^{*}
	(0.477)
AGENCY3	-1.788^{*}
	(0.440)
MONTH$\times 10^{-2}$	-1.187
	(1.600)
MONTHGL$\times 10^{-2}$	2.296
	(1.865)
WTMATCH$\times 10^{-2}$	2.455^{*}
	(0.856)
MAXOELP	11.075^{*}
	(1.428)
MNOFFER	0.394^{*}
	(0.104)
MATCH1	0.812^{*}
	(0.153)
INTERCEPT	-9.269^{*}
	(1.433)

As we can see from Table 14, *ceteris paribus*, the probability a match is successful is higher the longer a property has been on the market, the higher the maximum offer in the match relative to the listing price, the larger the number of offers that are exchanged in the match, and whether it is the first match. Also, holding everything else constant, in more active housing markets the probability of success of a match is lower.

4.3 Sale Agreement

The timing and terms of the sale agreement for the properties in our sample are summarized in Table 15 below. In the table, the effective listing price denotes the listing price at the time of the sale agreement.

Table 15: Sale price and time to sale

	Yorshire 95-98	London 95-96	London 97-98	Overall 95-98
Sale price vs effective listing price:				
Average as percent of listing price	95.0	96.8	97.6	96.2
Percent with prices equal	13.4	8.4	26.8	15.3
Percent with sale price greater	5.0	2.5	4.6	4.1
Time to sale				
Average	15	10	7	11
Median	10	7	5	7
Within 2 weeks	3.2	18.0	23.2	12.82
Within 20 weeks	75.8	89.1	93.94	84.49
Maximum	69	69	42	69

As we can see from Table 15, in a booming housing market sale prices are on average closer to the effective listing prices, a larger fraction of sales occur at the listing price, and properties sell considerably faster. Overall, properties in our sample sell at about 96% of their effective listing price and 13 percent of the properties sell at the listing price. The mean and median time to sale are 11 and 7 weeks, respectively.

Figure 2 plots the sale price of each property relative to its effective listing price as a function of the number of weeks since initial listing. About 11 percent of all properties took more than 26 weeks to sell and are omitted from the graph. A few relatively inexpensive properties (listed for less than £20,000) sell at a very large discount, up to 50 percent. In the vast majority of cases the sale price is below the listing price. A few transactions take place at a sale price above the listing price. These instances are due either to rounding up or to simultaneous bidding by competing buyers. The "luckiest"

seller at this game had a listing price of £99,950. He turned down an offer at £85,000 two weeks after initial listing. A few days later, 4 buyers started bidding against each others, pushing the price up to £125,000. Overall, Figure 2suggests that the longer a property is on the market, the lower its sale price relative to its listing price.

Recall from Table 7 above, that about three quarters of all sale agreements occur within the first match. In Table 16, we summarize information relative to sale agreements that follow an unsuccessful first match. In 13 percent of the cases properties sell at a price below the maximum offer in the first match, 20 percent sell for the same amount, and the remaining two thirds of the properties sell at a price above (see also Figure 3). On average, after an unsuccessful first match, sellers wait 6 weeks before reaching a sale agreement and realize a 4 percent gain relative to the best offer in the first match.[18]

Table 16: When first match unsuccessful

	Yorshire 95-98	London 95-96	London 97-98	Overall 95-98
Additional weeks to sale	8	6	3	6
Gain as percent of max offer first match	5.1	3.2	3.8	4.0
Percent sales below max offer first match	13.9	19.8	3.2	13.1
Percent sales at max offer of first match	20.8	14.1	23.8	19.5

What accounts for the timing and terms of a sale agreement? To investigate these issues we perform two empirical exercises. The first exercise consists of estimating a flexible functional form hazard for the probability a sale would occur in any given week since the listing of a property on the market. The set of time-invariant variables we consider includes property characteristics, agency dummies, MONTH, and MONTHGL. Our specification also includes three time-varying variables denoting the effective listing price in each week (ELISTP), the number of offers received each week, and the highest offer received each week as a proportion of the effective listing price (HOELISTP).[19] Maximum likelihood estimates and standard errors are reported in Table 17.

The only estimated parameter that is significant is the one associated with the variable HOELISP. Conditional on at least one offer being made on a property in any given week, the larger the best offer relative to the listing price, the higher the probability of a sale agreement. In particular, none of the terms in our quadratic specification in time is significantly different from zero.[20] This implies that the baseline hazard is constant. In

[18]This gain is large relative to the gain to the listing agent who earns typically only 1.8 percent of the sale price.

[19]This variable is equal to zero if no offer is received in a week.

[20]The same result holds for any polynomial specification.

Figure 2: Sale price and time to sale

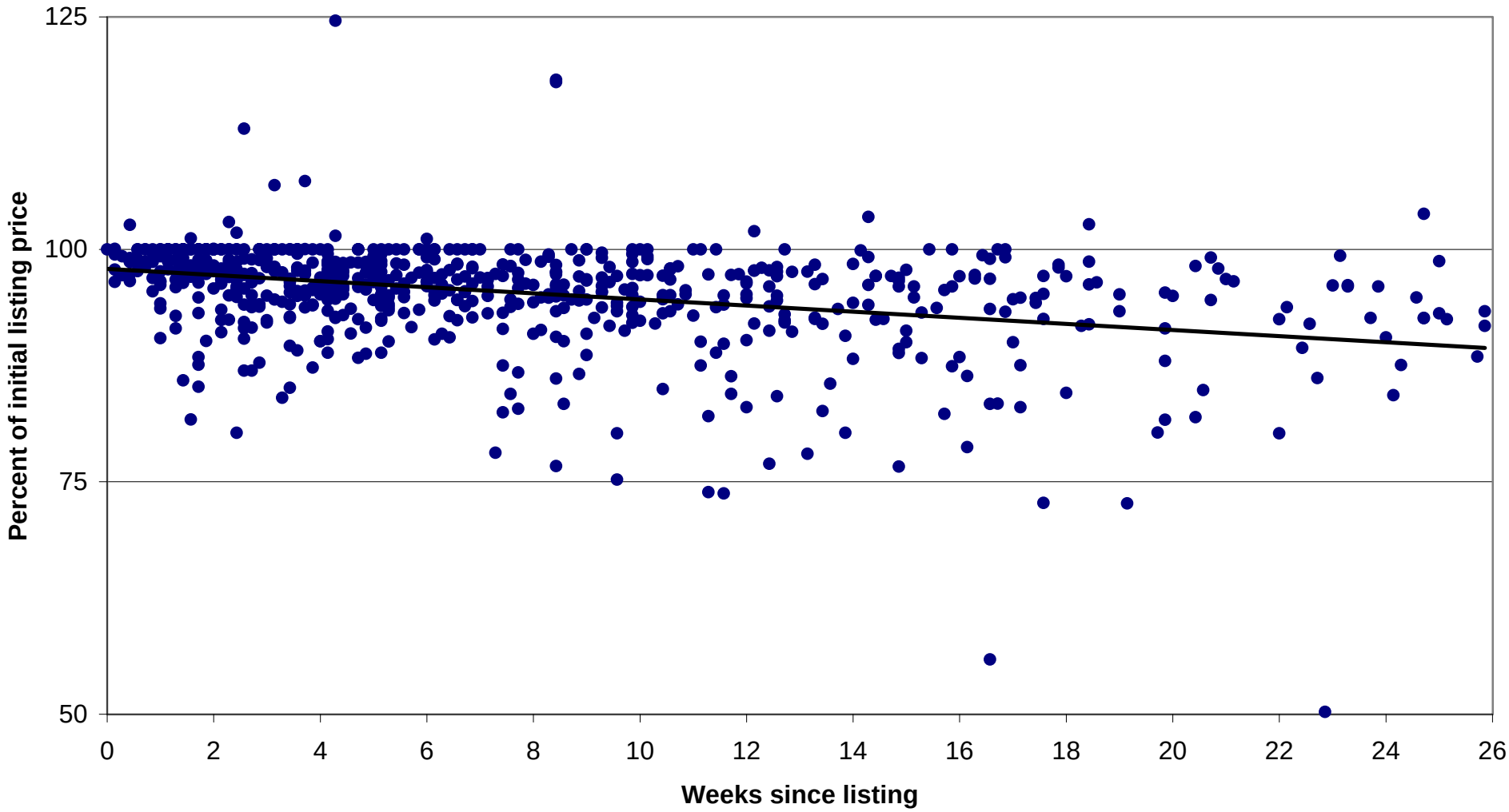

Figure 3: Gain when rejected first match

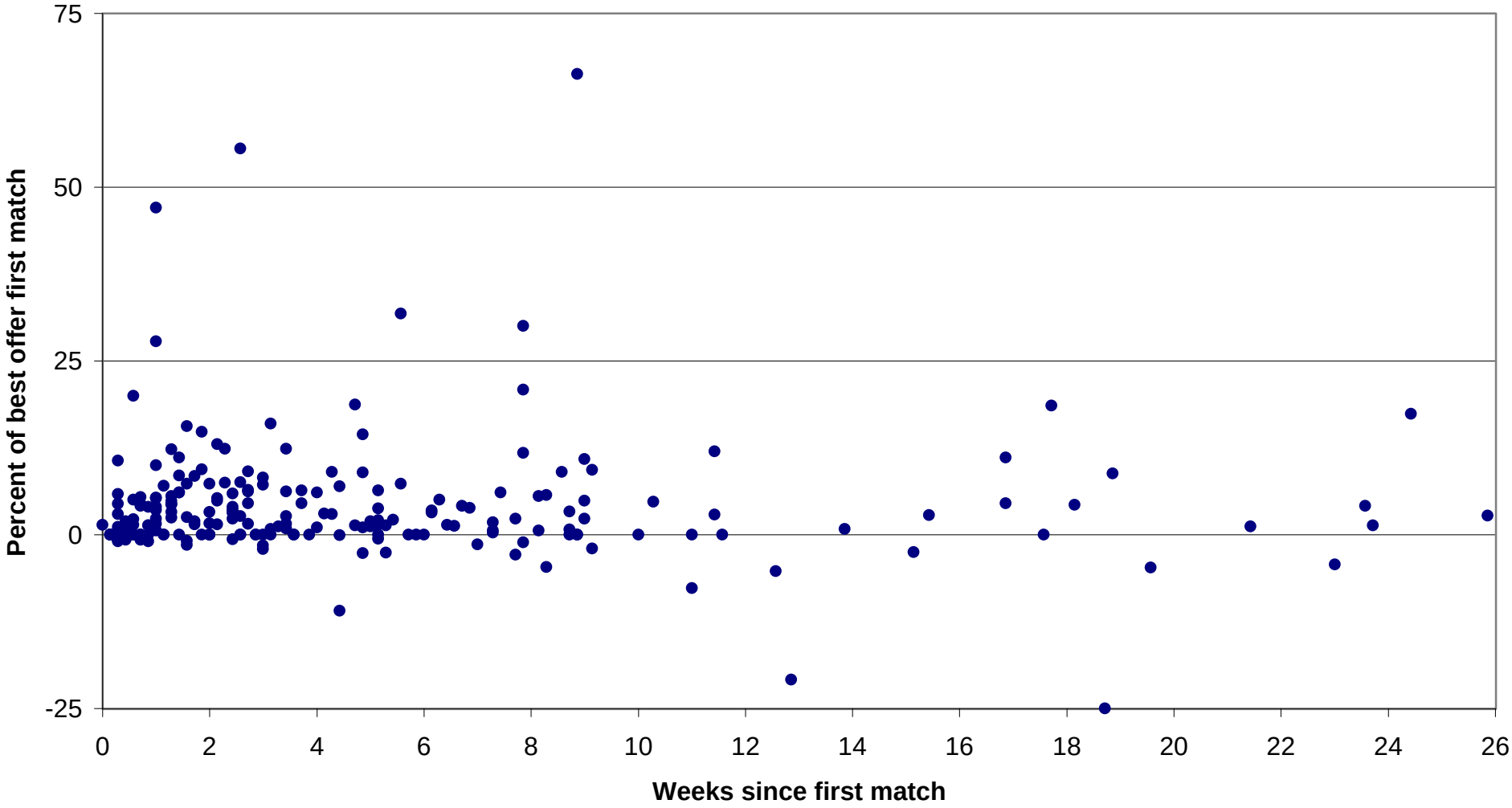

Table 17: Time to sale hazard estimation

Variable	Estimate
FLAT	0.094
	(0.329)
TERR	0.098
	(0.187)
DET	-0.067
	(0.288)
TOTA$\times 10^{-2}$	0.152
	(0.677)
NBATH	-0.058
	(0.157)
GARAGE	-0.060
	(0.172)
APPL	0.009
	(0.070)
B2	-0.075
	(0.363)
B3	-0.117
	(0.379)
B4	-0.022
	(0.509)
AGENCY1	-0.353
	(0.472)
AGENCY2	-0.443
	(0.534)
AGENCY3	-0.450
	(0.509)
MONTH	-0.647
	(1.318)
MONTHGL	0.764
	(1.751)
ELISTP $\times 10^{-6}$	0.450
	(4.777)
NOFFERS $\times 10^{-2}$	0.832
	(4.419)
HOELISTP	6.607*
	(0.753)
T $\times 10^{-3}$	3.825
	(23.703)
$T^2 \times 10^{-5}$	-0.352
	(56.096)
INTERCEPT	-6.217*
	(0.834)

other words, after conditioning on the arrival and the size of offers, the probability of a sale occurring in any given week is constant over time. These findings point to the rather obvious conclusion that the main determinant of whether a property sells in a given week is whether or not an offer is received and how high this offer is relative to the listing price.

The second empirical exercise we perform consists of regressing the sale price (SALEP) on the property characteristics, agency dummies, MONTH, MONTHGL, the initial listing price (ILISTP), the number of matches since initial listing (NMATCH), and the number of weeks from initial listing to sale agreement (WTSALE). The results are contained in Table 18.

As we can see from Table 18 the higher the initial listing price the higher the sale price. An active housing market and a booming market are also associated with higher sale prices. The shorter the time on the market and the higher the number of matches, the higher the sale price. Overall, the regression accounts for 99 percent of the variability in sale prices.

4.4 Viewings

For a sub-sample of 199 properties located in the local market within the Greater London metropolitan area where one of our agencies operates, our data set contains complete viewing records. A viewing is recorded each time a potential buyer visits a property. Information on viewings is summarized in Table 19 below.

On average, there are 9.5 viewings per transaction. Only 9 properties sell after one viewing. The median number of viewings is 7, the maximum is 51. The distribution of viewings is depicted in Figure 4. The average number of viewings per week on the market is 1.7. As illustrated in Figure 5, the arrival rate of viewings over time displays a monotonic decreasing pattern that is similar to the one observed for the arrival rate of matches.

Given the observable characteristics of a property, is the rate of arrival of viewers affected by the listing price? To answer this question we propose a Poisson regression of the viewings rate, measured by the number of viewings per week on the market, on the property characteristics, the effective listing price (ELISTP), and time on the market (TSALE).[21] The results are reported in Table 20 below.

[21]The regression results remain the same if the effective listing price is replaced by the initial listing price.

Table 18: Sale price

Variable	Sale Price
FLAT	-869
	(563)
TERR	-1190
	(336)
DET	626
	(453)
TOTA	9
	(11)
NBATH	-395
	(264)
GARAGE	101
	(306)
APPL	194
	(103)
B2	828
	(479)
B3	1092
	(561)
B4	530
	(859)
AGENCY1	991
	(739)
AGENCY2	548
	(885)
AGENCY3	1833*
	(776)
MONTH	18
	(23)
MONTHGL	69*
	(31)
ILISTP	0.942*
	(0.007)
NMATCH	430*
	(153)
WTSALE	−72*
	(13)
INTERCEPT	−1086
	(872)
R^2	.99

Figure 4: Viewings per transaction

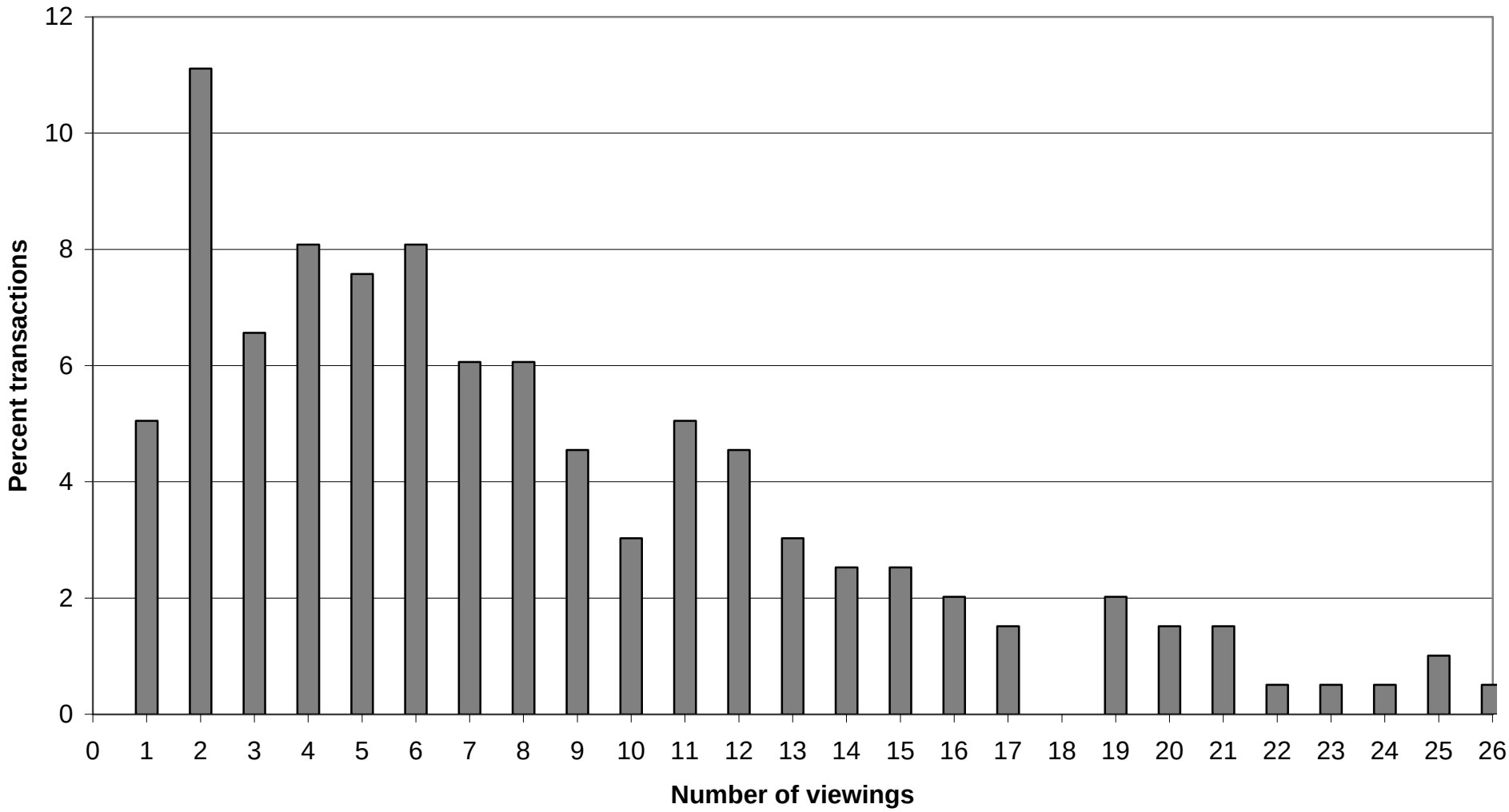

Figure 5: Viewings per property on the market, per week

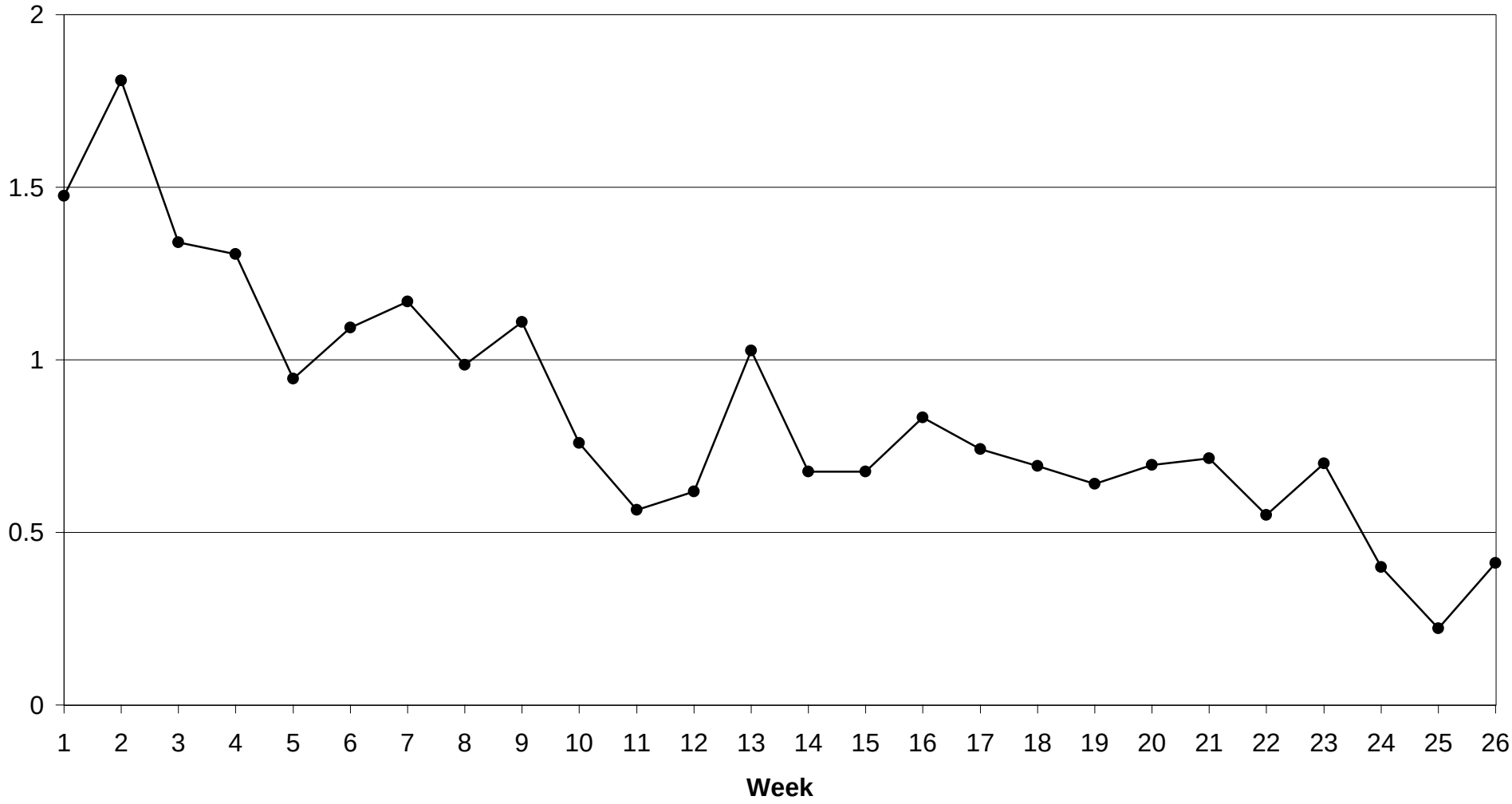

Table 19: Viewings

	London 95-98
Viewings per sale	
Average	9.54
Median	7
Minimum	1
Maximum	51
Viewings per week	
Average	1.74
Median	1.33
Minimum	.08
Maximum	11

As shown in Table 20, holding the characteristics of a property constant, a high listing price has a negative effect on the arrival rate of viewings. Also, time on the market and viewings rate are negatively correlated.

With the additional information on viewings available, we can now revisit some of the issues we addressed earlier and assess the role played by viewings in the process leading to the sale of a property. In particular, we ask whether viewings affect the sellers' decisions to revise their listing price, the arrival of matches, or the timing of sale agreements. To address these issues, for each week a property is on the market we define two variables that measure the number of viewings in the week (NVIEW) and the cumulative number of viewings from initial listing (CUMVIEW). We include these two additional explanatory variables in our econometric analysis of the time to first price change, the time to first match, and the time to sale. The outcomes of these exercises can be summarized as follows. First, the occurrence (or the lack) of viewings appears to have no effect either on the probability of observing a price change or on the probability of a sale agreement.[22] Second, the more viewings in a week and the greater the total number of viewings since initial listing, the higher the probability of receiving an offer that week. This is the main finding that emerges from the maximum likelihood estimates of a flexible functional form hazard for the probability a match occurs in any given week (see Table 21).

[22]The maximum likelihood estimates of flexible functional form hazards for these probabilities which include the additional variables on viewings are not reported here. They are available from the authors upon request.

Table 20: Poisson regression, viewing rate on effective listing price

Variable	Viewings per week
FLAT	-0.306^{*}
	(0.116)
TERR	-0.158^{*}
	(0.065)
DET	0.021
	(0.073)
TOTA$\times 10^{-2}$	-0.427^{*}
	(0.175)
NBATH	-0.121^{*}
	(0.051)
GARAGE	-0.204^{*}
	(0.051)
APPL	0.049^{*}
	(0.020)
B2	0.860^{*}
	(0.090)
B3	0.972^{*}
	(0.112)
B4	1.734^{*}
	(0.181)
MONTH$\times 10^{-2}$	1.191^{*}
	(0.348)
ELISTP $\times 10^{-5}$	-0.283^{*}
	(0.147)
TSALE $\times 10^{-3}$	-5.796^{*}
	(0.323)
INTERCEPT	-1.304^{*}
	(0.129)
Pseudo R^2	.35

Table 21: Time to first match hazard estimation

Variable	Estimate
FLAT	0.170
	(0.329)
TERR	-0.006
	(0.212)
DET	-0.080
	(0.257)
TOTA	0.291
	(0.679)
NBATH	-0.079
	(0.181)
GARAGE	0.135
	(0.178)
APPL	-0.012
	(0.063)
B2	-0.222
	(0.277)
B3	-0.255
	(0.377)
B4	-0.925
	(0.736)
MONTHGL $\times 10^{-2}$	1.583
	(1.177)
ELISTP $\times 10^{-6}$	1.983
	(5.339)
DPC	0.045
	(2.765)
NVIEW	0.207^{*}
	(0.033)
CUMVIEW	0.354^{*}
	(0.129)
T $\times 10^{-2}$	-0.562^{*}
	(0.233)
$T^2 \times 10^{-4}$	0.082
	(0.043)
INTERCEPT	-2.494^{*}
	(0.418)

Another interesting result that emerges from these estimates when compared with the ones reported in Table 8, is that after controlling for the arrival of viewings, a listing price revision no longer has any effect on the probability of arrival of the first match.

5 Discussion

In the previous section, we investigated a number of issues pertaining to the details of the process leading to the sale of a property, from its initial listing to a sale agreement. The purpose of this section is to summarize our main findings, put them in the context of the existing literature, and lay out the basis of a theoretical framework to interpret them.

By focusing the chain of events that follow the listing of a property, our main findings can be summarized as follows:

- Given the characteristics of the property and market conditions, the higher the listing price, the lower the arrival rate of viewings. The arrival rate of viewings declines with time on the market.
- Few sellers revise their listing price. Those who do typically reduce it by a substantial amount after waiting a substantial period of time without receiving any offer.
- The more potential buyers visit a property, the higher the probability a buyer makes an offer.
- The arrival rate of matches declines with time on the market. A listing price reduction increases the probability of arrival of the first match, indirectly by increasing the arrival rate of viewings.
- First offers are lower relative to listing price the longer the property has been on the market.
- First offers of first matches are lower than first offers of second and higher order matches; the probability the seller accepts the first offer is higher in a first match.
- Upon rejection of their first offer, a third of buyers walk away. This proportion is lower if the buyer is the first to make an offer on the property (a first match).

- Within a match, offers increase at a decreasing rate. The maximum number of offers observed is four. The more offers in a match, the broader the interval they cover relative to the listing price.
- The probability a match turns into a sale agreement is higher the longer the property has been on the market, the higher the maximum offer in the match, the larger the number of offers and if it is the first match.
- More than two thirds of sale agreements occur at the first match; more than a third of sale agreements occur at the first offer ever received.
- A few sellers who did not agree a price with their first match end up selling at a lower price than the best offer of the first match. Most gain a reasonable return.
- Sale price and time to sale are negatively correlated.
- The rate of arrival of offers and their levels relative to the listing price are the only determinants of the time to sale.
- Sellers in more active markets make fewer and smaller listing price revisions. They experience faster and more frequent matches, more and higher offers, faster sales, and higher sale prices relative to listing prices.

The process leading to the sale of a property can be thought of as a combination of a long-term optimization problem faced by the seller and a sequence of short-term bargaining problems between the seller and each potential buyer who initiates a negotiation by making an offer on the property.

The solution to the dynamic optimization problem faced by the seller yields an initial listing price and an intertemporal decision rule specifying whether, when, and to what extent he should revise the listing price as time goes by. To analyze these issues it is critical to understand what is the role played by the listing price. The evidence suggests that, after controlling for the characteristics of a property, the listing price affects the rate at which potential buyers visit the property. A high listing price is correlated with a low rate of viewings. Fewer viewings in turn imply a lower probability of receiving an offer.

The viewing rate gradually decreases with time on the market. The data does not show a discrete drop in the arrival rate of viewings after a week or two, once the stock of potential buyers waiting for new listings in the local market would have had a chance to visit the property. This finding stands in contrast to the stock-flow view of the market;

i.e., one whereby buyers who have not found anything they like upon entering the market, hang around waiting for new listings. There does not seem to be a stock of potential buyers waiting for new properties to be listed and going to view them upon listing. If there is, this stock is minimal relative to the regular flow of new potential buyers arriving on the local market in any given week.

On average, listing price reductions occur after a period equal to the average time to sell for the whole sample. The average size of the price drop is larger than the average difference between sale price and initial listing price for the whole sample. Not receiving any offer seems to be the main factor leading to a listing price reduction. We do not find evidence of a smooth tradeoff between the level of the listing price and the arrival rate of offers. However, listing price reductions do appear to boost the probability of receiving an offer.

Existing theories of the listing price are embedded in a static or stationary environment (see, e.g., Horowitcz, 1992, Yavaş and Yang, 1995, Chen and Rosenthal, 1996(a) and 1996(b), Arnold, 1999). Hence, they are not designed to propose any prediction as to optimal listing price changes. The only exception is the model in Coles (1998). In a stock-flow matching world, he finds the seller should decrease the listing price continuously over time. One could of course appeal to menu cost to rationalize our observation of few discrete changes for only one fifth of the properties. However, changing the price does not appear expensive at all, certainly not up to a level sufficient to justify sellers waiting so long to do it and dropping their price by such a large amount.

Turning our attention to the bargaining aspect of the process leading to the sale of a property, the terms of a sale agreement are the outcome of a negotiation between the seller and the (ultimate) buyer of the property. Not all negotiations between the seller and a potential buyer, however, end in a sale agreement. In fact, about one third of all negotiations terminate without an agreement. The more offers a buyer makes, the more likely he is to be successful. In more than half of all negotiations potential buyers are observed to make only one offer. Less than half the properties are sold at the first offer ever received.

The occurrence of delays in reaching agreement and the observation that some negotiations terminate without an agreement being reached suggest a bargaining environment where the interested parties possess some private information (see, e.g., Kennan and Wilson (1993)). To date, the theoretical literature on housing transactions has instead focused primarily on bargaining models with complete information.[23] While complete

[23]See the references cited above.

information bargaining models are obviously the first choice in the absence of empirical evidence that directly refutes their implications, our analysis clearly indicates that such models are inadequate to explain the data.

Time on the market seems to affect the level of buyers' offers as well as the strategy of the sellers, both in terms of listing price and response to given offers. This observation, suggests the presence of non-stationarities like for example a finite-horizon effect. Holding time on the market constant, we also find that the level of the first offer by a potential buyer is lower and the probability that the seller accepts a given first offer is higher in the very first negotiation the seller engages in relative to later negotiations. Together, these observations suggest an environment where the seller possesses private information and relatively "tougher" sellers are more likely to engage in multiple negotiations.

6 Concluding Remarks

In this paper we have analyzed a new data set of housing transactions in England. The main novelty of the data is the record of all listing price changes, all offers ever made on a property, and, for a subset of the sample, all viewings. This data has enabled us to supplement anecdotal with statistical evidence, hence providing a more accurate picture of the process by which residential properties are transacted.

To the eyes of an economist, and in light of existing theories of housing transactions, a puzzling feature that emerges from our data is the limited extent to which sellers and buyers experiment. First, most sellers do not revise their listing price, and no seller adjusts their listing price gradually over time. Second, few viewings turn into an offer. When they do, they often lead to a sale. Third, during the bargaining process most buyers make a small number of offers. A large fraction of them only make one offer, sometime at the listing price. This evidence seems surprising in light of the fact that listing price changes and offers are fairly costless activities. Furthermore, the conventional wisdom about housing transactions is that they entail a great deal of uncertainty about the buyers' and sellers' valuations of properties.

In an attempt to further improve our understanding of this market, forthcoming research will propose a game theoretic model capable of reproducing the main features of the data. Estimating this model should provide an appreciation for the degree of inefficiencies in the current market arrangement and test alternatives.

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