Is there a stable matching function in the market for existing homes?[1]

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(First and Very Preliminary Draft: November 3 2008)

Housing markets clear not only through price but also through the time that a buyer or seller spends on the market. Given the idiosyncratic nature of existing homes, and the consequent need for buyers to examine a home before making an offer on it, trading in this market is a time consuming process. A shock to demand need not necessarily be translated solely into price but may affect duration as well. Thus an understanding of the determinants of duration is crucial to understanding how this market works.

There is a relatively large number of studies that have explored the *individual* level determinants of seller time on the market, such as the idiosyncrasy of the property (Haurin, 1988), seller motivation (Glower et al., 1998) the equity position of the owner (Genesove and Mayer, 1997) and the previous purchase price (Genesove and Mayer, 2001). More recent papers include Levitt and Syverson (2005), Hendel, Nevo and Ortalo-Magne (2007), Bernheim and Meer (2008). There is a more limited literature on the individual determinants of buyer time on the market; it essentially boils down to Elder, Zumpano and Baryla (1999), Baryla, Elder and Zumpano (2000) and D'Urso (2002). [2]

Missing from the existing literature is any study of the *market* determinants of the duration. This paper is meant to remedy that. We aggregate the micro data from the biannual/annual National Association of Realtors' surveys of buyer and seller behaviour to the MSA level, for available years from 1987-2007, to form market-level measures of buyer and seller time on the market, and number of homes visited. Given the uniqueness of our data, we chose to analyze them in a number of different ways: (a) the co-variation of the

[1] We acknowledge the generous assistance of Ed Baryla, Glenn Crellin, Harold Elder and Len Zumpano for variously providing us with data, codebooks and questionnaires.

[2] All three papers use data from N.A.R. buyer surveys.

variables of interest, (b) a reduced form analysis, conditioned on average income and population, as proxies of demand, and (c) a structural analysis of the relationship between buyer and seller time on the market.

We preface our empirical results by a search-matching theoretic analysis that we believe captures the essential elements of a steady state analysis of a shock to demand in the existing homes market. The analysis shows that an increase in buyer willingness to pay is expected to increase price by nearly the increase in willingness to pay, and decrease seller time on the market; its effect on buyer time on the market is ambiguous, since the frequency of buyer contact with seller will (weakly) decline, but each meeting is somewhat more likely to lead to a transaction.

We find that buyer and seller time on the market is positively correlated, both across markets, and over time within markets, and note that this is inconsistent with a fully exogenous matching function, in which transactions depend only on the ratio of buyers to sellers. We also find that search behaviour of both buyers and sellers is insensitive to current population and income, as well as to price, which is consistent with the theoretical model under a zero interest rate. Our results change substantially, however, if we condition on price *changes*. We find then that the correlation between buyer and seller time on the market disappears, and that seller time on the market is clearly decreasing, while buyer time on the market and the number of homes visited are also decreasing, although less clearly so. We offer an interpretation for these findings based on lagged seller reaction to buyer demand increases.

The Model

At the center of any search/matching model is the matching function, which maps the number of buyers (B) and sellers (S) to the number of contacts between them:

$m = m(B,S)$. We make the usual constant returns to scale assumption, so that the probabilities that a given buyer or seller makes a contact with the other side is a function only of the ratio of buyers to sellers, which we denote as $\theta = B/S$. Thus a given buyer will make a contact with a seller with probability $h(\theta) \equiv m(B,S)/B = m(1,\theta)$, while a given seller will make a contact with some buyer with probability $q(\theta) \equiv m(B,S)/S = m(\theta,1)$.

Standard, and intuitive, assumptions on the matching function make h a downward sloping function and q and upward sloping function of θ. But there the limiting case in which h is constant is worth discussing, as it corresponds well to most North American real estate institutions. In those markets, sellers list their property while, as a rule, buyers do not generally advertise their availability. Thus buyers seek out sellers.[3] If we further assume that a buyer's opportunity to search for a home (i.e., an hour free of work and other duties in which they can go with the real estate agent to a home) arises independently of other buyers at constant rate ρ (i.e., all buyers don't go searching on Sundays). The buyer (or the agent) chooses a house to look at randomly, and so for any given house with probability 1/S. With probability λ a house is acceptable to the buyer. Thus the probability of a match for a given buyer at any given moment is $h = \rho\lambda$ (note that it is independent of the number of buyers (B) or sellers (S)) and so the matching function is $m = kB$[4] and $q = k\theta$. If buyers' search opportunities agglomerate in time (everyone goes searching on Sundays) or offers last over some interval of time, during which another buyer can show up, then a buyer's match probability will be decreasing in the number of buyers, with whom he competes and increasing in the number of sellers (which it increases the chance that a given other buyer will end up elsewhere than at the unit the given buyer visits).[5]

[3] It is an interesting question: why do the Multiple Listing Services list sellers and not buyers? The answer is, of course, that it is easier to describe the home and perhaps the sellers' willingness to sell (via the list price), than to describe the buyer's preferences.
[4] See Mortensen and Pissaridies. This is the specification used in Wheaton (199x).
[5] Also, if agents first try to match their own buyers and sellers.)

For a given buyer, the net present value of owning a given home is V, a random variable whose distribution is G. V is idiosyncratic to the buyer-home match; its value tells us nothing about the value to the same buyer of any other home, or the value to any other buyer of owning the given home. The value of the random variable is assumed unknown to both the buyer and seller before the contact, and observed by both of them upon the contact. If there is no transaction both buyer and seller continue searching.

Let V^B denote the value of continued searching for the buyer, and V^S for the seller. Under efficient bargaining, there will be a transaction if and only if the value of owning the home exceeds the sum of searching for buyer and seller, i.e., iff $\geq V^B + V^S \equiv y$. The probability of a transaction given a meeting is therefore $1 - G(y)$. The expected surplus of a transaction, when positive, is $E[V|V \geq y] - y$, where E is the expectation operator for distribution G.

We assume that there is Nash bargaining, with the seller obtaining β of the surplus, which is $V - y$. Thus the asset equation for the value of the seller's search is

$$(1) \quad rV^S = -c^S + q(\theta)\beta\big(1 - G(y)\big)(E[V|V \geq y] - y)$$

Similarly, the asset equation for the value of a buyer's search is

$$(2) \quad rV^B = -c^B + h(\theta)(1 - \beta)\big(1 - G(y)\big)(E[V|V \geq y] - y)$$

In our baseline model, we assume that there is an infinite supply of buyers at V^B. With V^B a constant, can rewrite the above equations as

(3) $ry = -(c^S - rV^B) + q(\theta)\beta\big(1 - G(y)\big)(E[V|V \geq y] - y)$

(4) $0 = -(c^B + rV^B) + h(\theta)(1 - \beta)\big(1 - G(y)\big)(E[V|V \geq y] - y)$

Both equations present the asset value of a searcher, with offer distribution $G$and optimal reservation price y. In the first equation, the search cost is $c^S - rV^B$, the interest rate is r and the offer arrival rate is $q(\theta)\beta$. In the second equation, the search cost is $c^B + rV^B$, the interest rate is zero, and the offer arrival rate is $h(\theta)(1 - \beta)$. Since $q'(\theta) > 0$ the solution in y of the first equation is upward sloping in θ; call that the seller reservation surplus curve. Since $h'(\theta) < 0$ the solution to the first equation in y (the buyer reservation surplus curve) is of course downward sloping in . Where these two curves cross defines the unique equilibrium in y and θ (see Figure 1). The corresponding average transaction price is

(5) $$EP = \beta(E[V|V \geq y] - y) + V^S = \beta(E[V|V \geq y] - y) + y - V^B.$$

The effect of an increase in buyers' willingness to pay is easy to discern, with the help of standard results from search theory. We initially assume a positive interest rate. From Mortensen (1986, p. 864), we know that an increase in a location parameter of the offer distribution will increase the reservation price by a positive amount that is less than the increase in the location parameter, so long as the interest rate is positive. Thus an increase in the location parameter of the offer distribution will shift up the seller reservation surplus curve, but by less than the increase, while it will shift up the buyer reservation surplus curve one for one, resulting in a higher buyer/seller ratio and a higher (although by less than the increase in the willingness to pay) reservation surplus value, as in Figure 2.

The effect on price depends on the shape of the right tail of G. A convenient specification is the Generalized Pareto distribution[6], for which

$$1 - G(V; c, k, v) \equiv (1 - c(V - v)/k)^{1/c}, \qquad V \geq v.$$

(This reduces to the exponential distribution for $c = 0$, the uniform distribution for $c = 1$, and Pareto distributions for $c < 0$.) Since $E[x|x \geq \bar{x}] = (k - c(\bar{x} - v))/(1 + c) + \bar{x}$ for $c > -1$, under this condition, $EP = \beta((k - c(y - v)/(1 + c)) + y - V^B$ $= [\beta k + \beta c v + (1 + c(1 - \beta))y]/(1 + c) - V^B$, so that average price also increases. Since the reservation surplus value increases by less than the willingness to pay, average price increases by less than willingness to pay as well if and only if $\beta < (1 + c)/c$, which is guaranteed to hold if $c \geq 0$.

The implication of the demand shift for time on the market is as follows. With the reservation surplus value y increasing less than the location parameter, the probability of a transaction given a meeting between buyer and seller must fall. With the increase in the buyer-seller ratio θ, the probability that a seller will have a contact with a buyer, which is $q(\theta)$, increases. Thus the probability that a seller will sell, which is, $q(\theta)(1 - G(y - v))$, also increases and seller time on the market decreases.

For buyer time on the market, matters are somewhat more complicated. In general, the probability of a contact with a seller, $h(\theta)$, is decreasing in θ, so that the probability that a buyer will buy, $h(\theta)(1 - G(y - v))$, may go either up or down. Obviously in the special case described above, in which h is constant, we can unambiguously conclude that the probability that the buyer will buy will increase.

[6] See Johnson, Kotz and Balakrishnan, 1994, p..614-620.

It will also prove useful to consider the special case in which the interest rate is zero. In that case, an increase in the willingness to pay will shift up the seller reservation price one for one as well, so that the reservation surplus value will increase by the amount of the willingness to pay, as will the average price. θ will remain unchanged, as will the conditional probability of a transaction, and so the unconditional probabilities as well. Obviously, if the interest rate is positive, but small, the outcome will be close to the zero interest rate outcomes.

Theoretical extensions.

This model makes a number of simplifying assumptions. The first is that buyers do not anticipate being sellers at some point in the future. Building that into the model, makes no essential difference. To do so, we assume that a owner has a constant hazard, λ, of becoming mismatched with his home. The return to being an owner is thus

$$rV(u) = u + \lambda(V^S - V(u))$$

so that a transaction will be consummated if $u \geq (r+\lambda)y - rV^S \equiv z$. The expected surplus, conditional on it being positive, is now

$$E\left[\frac{u + rV^S}{r+\lambda}\middle| u \geq z\right] - y = \frac{1}{r+\lambda}\{E[u|u \geq z] - z\}$$

so that the surplus reservation value equations can be written as

$$0 = -(c^B + rV^B)(r+\lambda) + h(\theta)(1-\beta)\big(1 - G(z)\big)(E[u|u \geq z] - z)$$

$$rz = -r(c^S - (r+\lambda)V^B) + q(\theta)\beta\big(1 - G(z)\big)\frac{r}{r+\lambda}(E[u|u \geq z] - z),$$

so that all our results follow as before, except for the condition for price to increase less than v. The corresponding average transaction price is $EP = \beta(E[V|V \geq y] - y) + V^S = \frac{1}{r+\lambda}\beta(E[u|u \geq z] - z) + \frac{z-(r+\lambda)V^B}{\lambda}$. Under the GPD assumption, this reduces to $EP = \frac{1}{r+\lambda}\beta((k - c(z - v)/(1 + c)) + \frac{z-(r+\lambda)V^B}{\lambda}$, so that average price also increases, and it increases by more than the willingness to pay if and only if $\beta > (\lambda - d)(r + \lambda)(1 + c)/\lambda c(1 - [dy/dv])$.

A second assumption is that the supply of buyers is infinitely elastic. Assume, instead, that the flow of buyers into the market is a linear function of the value of buyer search: $a_B + d_B V^B$. Assume, likewise, that the flow of new sellers is a linear function of the value of seller search: $a_S + d_S V^S$. (The specification for sellers assumes that all sellers are offering newly constructed homes.) In stationary state, these flows have to equal each other. Using the definition of y, we obtain

$$V^B = \frac{a_S - a_B}{d_B + d_S} + \frac{d_S}{d_B + d_S} y$$

$$V^S = -\frac{a_S - a_B}{d_B + d_S} + \frac{d_B}{d_B + d_S} y$$

and so buyer and seller surplus reservation value equations

$$r\frac{d_S}{d_B + d_S} y = -(c^B + \frac{a_S - a_B}{d_B + d_S} r) + h(\theta)(1 - \beta)\big(1 - G(y)\big)(E[V|V \geq y] - y)$$

$$r\frac{d_B}{d_B + d_S} y = -(c^S - \frac{a_S - a_B}{d_B + d_S} r) + q(\theta)\beta\big(1 - G(y)\big)(E[V|V \geq y] - y)$$

From Mortensen, we have that the buyer surplus reservation value increases by

$\frac{dy}{dv} = \frac{h(\theta)(1-\beta)(1-G(y))}{r\frac{d_S}{d_B+d_S}+h(\theta)(1-\beta)(1-G(y))}$ and the seller surplus reservation value by

$\frac{dy}{dv} = \frac{q(\theta)\beta(1-G(y))}{r\frac{d_B}{d_B+d_S}+q(\theta)\beta(1-G(y))}$, so that the buyer surplus reservation curve will shift up more if and only if $\frac{d_S}{d_B} < (1-\beta)h(\theta)/\beta q(\theta) = (1-\beta)/[\beta\theta]$. This generalizes our baseline model, for which d_B is essentially infinite. It seems a reasonable assumption that even if not infinite, the sensitivity of the flow of buyers to the value of search is more sensitive than that of sellers, both because buyers may have a number of location options and because building new units is time consuming. Unless sellers have very little bargaining power, or the ratio of buyers to sellers is very large, our conclusions will remain those of the baseline model.

Given the stationarity of the model, we can proxy probabilities by the expected time of exit. Thus the expected time to sell is $1/[q(1-G)]$, and its logarithm is $-\ln[q(1-G)]$. Likewise the log of the average buyer time on the market equals $\ln(h(1-G))$. Since the expected number of homes that a buyer will visit is 1/(1-G) we can easily separate out the conditional probability of a transaction.

Data

We constructed a panel dataset from a number of different sources. Our primary data source is the micro data of eleven separate surveys of home buyers and sellers conducted by the Research Division of the National Association of Realtors (NAR), which, when aggregated up to the MSA level, provide us with buyer and seller time on the market and the number of homes visited by the buyer. These surveys were conducted biannually between 1987 to 2003 and annually between 2003 to 2007. Other than for the years 1997 and 1999, we have obtained the entire micro data for surveys conducted between 1987 and 2007.

The combined sample contains 53,505 survey responses and covers 330 unique MSAs. Table 1 presents the numbers of households and MSAs covered in each year. It should be noted that each year the questionnaires were sent to recent home buyers to collect information on the home buying process. Among these buyers, those who have owned and sold their previous homes also provided the information on their home selling process, although the year of sale is ascertainable only if it was within two or three years of the purchase date. Thus, the survey method combined with our data requirement selects only those sellers who have bought another house within two or three years after selling their home.

We should also state outright that the response rates of these surveys are extremely low. We nonetheless proceed with the analysis of the data since (a) there is no other source for buyer search behaviour and (b) our primary measure of interest is the correlation a between buyer and seller behaviour, which are derived from the same respondents. So whereas one might suspect, say, that average buyer time on the market among respondents differs from that of the universe of buyers (respondent might be more patient than non-respondents, for example), one might be less suspect of the correlation of buyer and seller time on the market among the respondents. Furthermore, we have an alternative measure of seller time on the market from Realtor association web sites than can be compared with the survey based measures to gauge the differences in the means (although we have not done so in this draft).

Using the individual NAR level data, we construct the following time-varying MSA level variables: (1) the median time on the market for buyers (BTOM); (2) the median time on the market for sellers (STOM); (3) and the median number of homes visited by buyers (BVISIT). We use the median and not the average, since the variables are top coded in certain years.

Buyer time on the market is based on responses to questions of the form 'How long did you actively search before you located the home you recently purchased?' while seller time on the market is based on responses to questions of the form 'How long was this home on the market?' In both case the answers are provided in the number of weeks. Number of homes visited is based on responses to questions of the form 'Including the home you purchased, how many homes did you walk through and examine before choosing your home?'

Data on the number of home sales are obtained from the HMDA loan application registers provided by the Federal Financial Institutions Examination Council (FEIFC). By law, all lending institutions located within a metropolitan statistical area (MSA) with assets in excess of $10 million are required to file loan application registers with the FFIEC for each mortgage loan application they receive. Reported information includes the purpose of the requested funds (home purchase, refinance, or home improvement), the dollar amount of the loan request, whether the dwelling is owner occupied, the census tract in which the dwelling securing the loan is located, and whether the application was approved or denied. Based on this information, we compute the number of home purchase loans that were approved in each MSA for each year.

Data on the MSA-level population and income are obtained from the Bureau of Economic Analysis (BEA). Data on the housing price indices are derived from the U.S. Office of Federal Housing Enterprise Oversight (OFHEO). The OFHEO tracts average house price changes in repeat sales or refinancing on the same single-family properties and are based on analysis of data obtained from over 11.9 million repeat transactions over the past thirty years.

Table 1 reports the number of households and MSAs by year, and overall in the N.A.R. microdata. Table 2 provides descriptive statistics of the variables in our study. The weighted average (across MSAXyear observations) of the median time on the market for buyers is 8.2 weeks. The weighted average of the median time on the market for sellers is 4.4 weeks. Note that the shorter duration for the time on the market for sellers may be partly due to sample selection issue mentioned above. The weighted average median number of homes that buyers see is 3.8.

Table 3 reports the correlation matrix for the key variables. Several observations follow. First, the time on the market for buyers is significantly positively correlated with the time on the market for sellers, suggesting a predominant hot vs. cold variation. Second, the number of home sales is negatively correlated with the time on the market for both buyers and sellers, suggesting a scale effect. Third, the number of homes visited by buyers, measured by BVISIT, is associated with a longer time on the market both for the buyers and sellers, indicating that any possible contrary movement in the probability of a contact is dominated by variation in BVISIT. Finally, while the correlations between both sellers' time on the market and the number of homes visited and house price growth are economically and statistically negative, that between buyers' time on the market and price growth is much weaker and less significant. We will see very similar results in the regression analysis.

Results

We first consider whether the cross-city relationship between the variables of interest and our proxies for demand are consistent with the model. Obviously, this requires the complementary assumption that the matching function at most varies randomly across the cities. In essence, this means that wealthier cities do not have better real estate technology.

Columns (1), (4) and (7) of Table 4 shows the between regression. Only in the case of seller time on the market is there any relationship between our demand proxies and the search outcomes. The relationship between seller time on the market and average income is certainly consistent with the model.

[Here: a fuller discussion of tables 4 and 5. Apologies for the incompleteness.]

A simple dynamic extension to our basic model can rationalize these results. Say that sellers only react with a lag to the shock to the quality distribution. This is wholly reasonable: when buyers arrive with large offers, sellers will tend to think at first that these are simply large offers from an unchanged distribution, and will not adjust their reservation price. (Genesove and Mayer (1997, 2001) provide additional reasons for slow seller adjustment when prices are falling.) Consider a two period model, in which sellers maintain their initial reservation price in the first period, and then fully adjust to the new stationary state in the second. If we maintain the assumption that buyers flow in and out of the market so as to keep the value of buyer search constant, the enhanced willingness to pay must be offset by an increase in the buyer seller ratio in the first period. Specifically, θ will increase to $\tilde{\theta}$, in Figure 2, which is the value that ensures that equation (3) holds with V^B and V^S, and so y, held constant, and at the new match quality distribution. Consequently, $q(\theta)$will increase, while $h(\theta)$ will decrease. The conditional probability of a transaction, , $1 - G(y - v)$ increases, so that the probability of a seller transaction increases, while the sign of the change of that for a buyer is ambiguous. Price increases. Its value is $EP = \beta E[V|V \geq y] + (1 - \beta)$. Using the GDP assumption, $dEP/dv = \beta/(1 + c)$.

To recall, we assume that in the second period, there is full adjustment to the new stationary equilibrium. Price therefore increases further in the second period, as a result of sellers increasing their reservation price, so that. Crucially for our argument, and in the simplest case of a zero interest rate, price adjusts more in the first period than in the second period if and only if $\beta > (1 + c)/2$. This explanation of the empirical results requires at least one of the following conditions to hold: (a) $\beta > 1/2$, sellers have more bargaining power than buyers, (b) $c < 0$, that is, the match quality distribution is more right skewed than the exponential distribution, (c) the interest rate is sufficiently low that, yet sufficiently high that . One reason that sellers might have more bargaining power than buyers is that at times there are *de facto* auctions over homes, whereas casual observation, at least, suggests that auctions over buyers, when several sellers bid for the same buyer, are rare.

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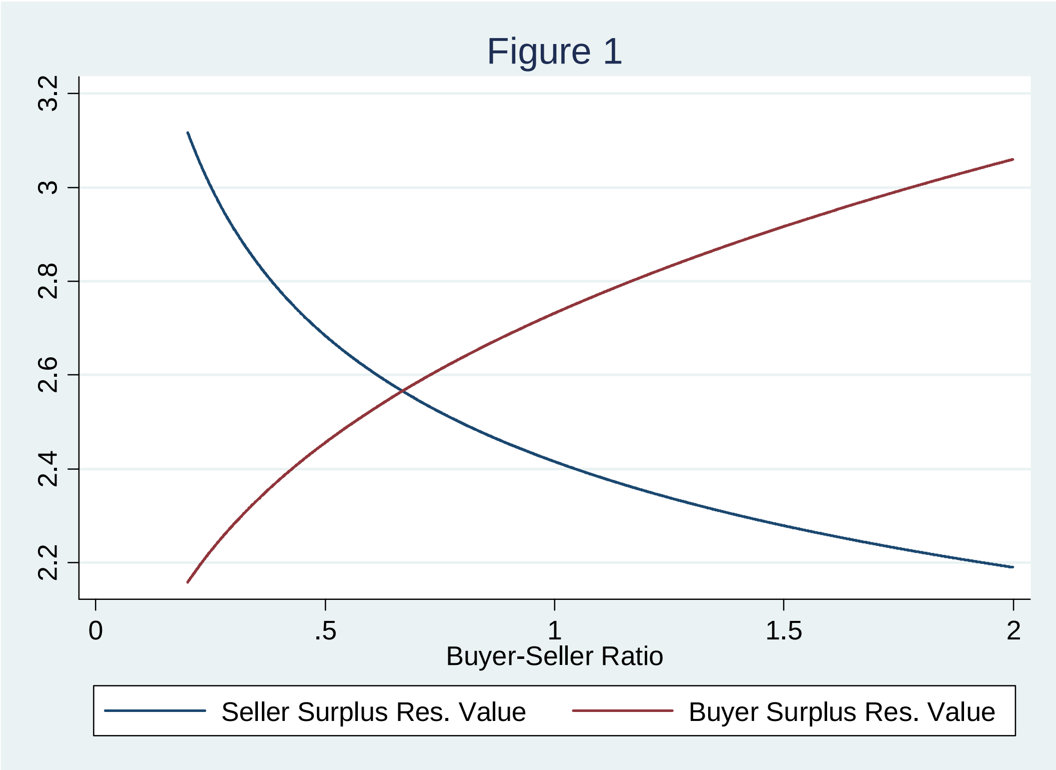
Figure 1
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Buyer-Seller Ratio
Seller Surplus Res. Value
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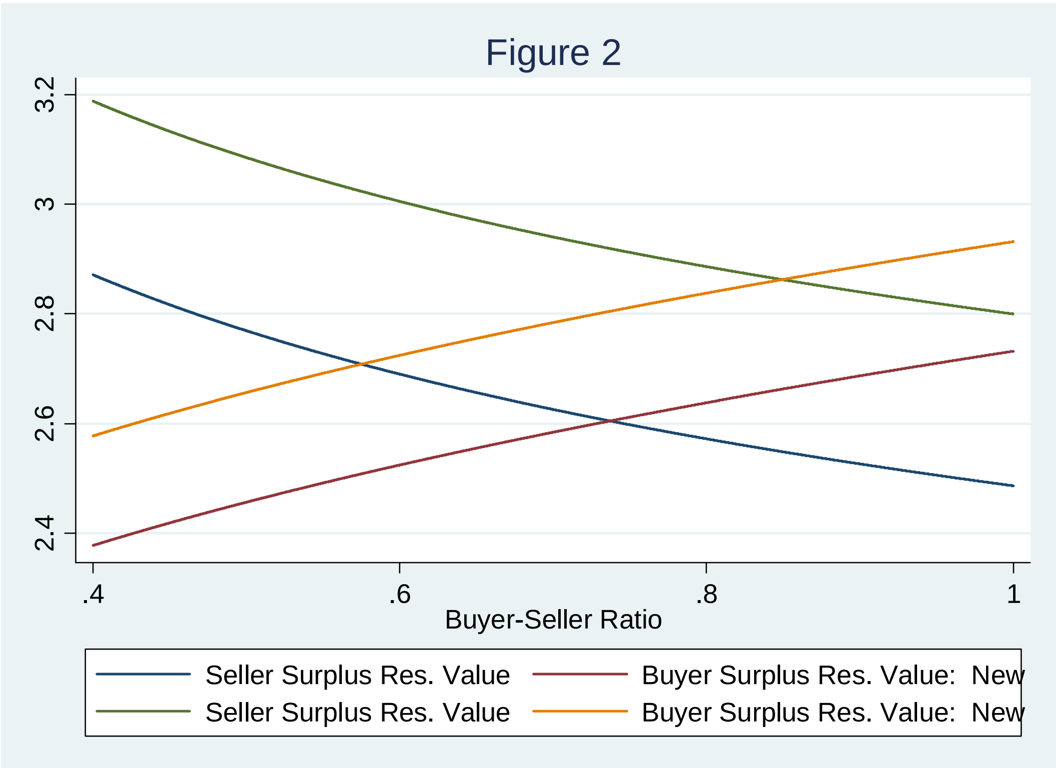
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Buyer-Seller Ratio
Seller Surplus Res. Value
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Seller Surplus Res. Value
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Table 1: NAR Sample Observations

Year	Number of Households	Number of MSAs
1987	**3,999**	**90**
1989	**Not appended yet**	**Not appended yet**
1991	**3,725**	**132**
1993	**1,969**	**178**
1995	**1,483**	**153**
2001	**5,617**	**182**
2003	**3,702**	**210**
2004	**8,203**	**253**
2005	**7,550**	**253**
2006	**7,548**	**274**
2007	**9,982**	**279**
All years	**53,505**	**330**

Table 2: Summary Statistics

Variable	Mean	S.D.	1987	1995	2003	2007
Med. Seller Time on the Market (STOM)	4.5	1.8	4.9	5.4	4.2	4.9
Med. Buyer Time on the Market (BTOM)	8.2	3.3	7.2	8.1	8.1	8.7
Med. Number of Homes Visited (BVISIT)	3.8	0.7	4.5	4.4	3.7	4.1
						2006
Ln(Population)	13.0	1.0	13.3	13.2	12.9	12.9
Ln(Avg. Income)	3.3	0.3	2.8	3.1	3.4	3.5
Ln(House Price) (lnHPI)						
Change in Ln(House Price) (DlnHPI)						

Table 3: Correlation Matrix

	lnSTOM	lnBTOM	lnBVISIT	lnHPI	DlnHPI
lnSTOM					
lnBTOM	.09				
lnBVISIT	.16	.17			
lnHPI	-.19	-.07	-.45		
DlnHPI	-.39	-.06	-.38	.52	

Table 4: Cross MSA, Time Averaged (Between: BE) and Fixed Effects (Within: FE) Regressions of Duration and Homes Visited on population and average income

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. Var.	lnSTOM			lnBTOM			lnBVISIT		
	BE	FE		BE	FE		BE	FE	
Avg. Inc.	-.24	-1.54		-.02	-.32		.08	-.80	
	(.13)	(.94)		(.15)	(.60)		(.07)	(.39)	
Population	- .00	-.03		-.01	-.38		-.015	.02	
	(.02)	(.55)		(.02)	(.33)		(.010)	(.15)	
p-value:									
Avg inc&pop	.08	.22		.71	.91		.31	.12	
AvgInc+pop	.09	.22		.95	.01		.21	.06	
R-squared	.11	.40		.06	.32		.20	.54	

All regressions include year dummy variables. Average Income and population are in logs. The p-values are for the joint hypothesis of zero coefficients on average income and population, and the test that the sum of the coefficients equal zero (i.e., that ln(income) has a zero effect). Standard errors are in parentheses.

Table 5: Fixed Effects Regressions of Duration and Homes Visited on

population, average income and price indices

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. Var.	lnSTOM			lnBTOM			lnBVISIT		
Avg. Inc.	-1.24	-.37	-.11	.19	.14	-.13	-.88	-.74	-.68
	(1.06)	(.87)	(.91)	(.57)	(.59)	(.60	(.41)	(.39)	(.38)
Population	.03	.63	.71	-.26	-.30	-.39	-.04	.13	.15
	(.53)	(.48)	(.49)	(.33)	(.35)	(.36)	(.14)	(.14)	(.15)
Price	-.16	-3.58		-.31	-.09		-.00	-.57	
	(.29)	(.80)		(.15)	(.45)		(.09)	(.20)	
Lagged Price		3.90			-.25			.65	
		(.92)			(.41)			(.20)	
Price Change			-3.59			-.07			-.57
			(.80)			(.47)			(.20)
p-value:									
Avg inc&pop	.49	.41	.35	.70	.67	.59	. 10	.13	.15
AvgInc+pop	.34	.35	.43	.50	.51	.13	.04	.04	.05
P + lagP=0		.29			.008				
R-squared	.40	.47	.46	.29	.29	.28	.56	.38	

All regressions include year dummy variables. Average Income , population and prices are in logs. The p-values are for the joint hypothesis of zero coefficients on average income and population, and the test that the sum of the coefficients equal zero (i.e., that ln(income) has a zero effect).