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Authors

Gau, George W.

Quan, Daniel C.

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Market Mechanism Choice and Real Estate Disposition:
Negotiated Sale Versus Auction*

by

George W. Gau

Department of Finance
University of Texas
Austin, TX 78712-1179

and

Daniel C. Quan

Anderson Graduate School of Management
U.C.L.A.
405 Hilgard Ave.
Los Angeles, CA 90024-1481

and

Department of Finance
University of Texas
Austin, TX 78712-1179

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Market Mechanism Choice and Real Estate Disposition: Negotiated Sale Versus Auction

Abstract

In this paper, we propose a model of mechanism choice in the disposition of real estate assets. Specifically, we consider two alternatives: a search or negotiated sale and an auction. Within the search framework, we derive an equilibrium whereby buyers incur costly search and sellers must incur holding cost for the period the property is not sold. In the auction alternative, the seller joins an existing pool of other sellers in undertaking a sequential multiple-object auction. Buyers and sellers freely choose their mechanism which in equilibrium is optimal given each group's conjectures about the mechanism choice of their counterparts. In equilibrium, each agent cannot benefit from deviating from his choice and his beliefs are consistent with the equilibrium outcome. It is shown that buyers with high search cost will choose auctions because the auction payoff impose an upper bound on buyers' gain from search.

An empirical model is estimated which tests for price differences due to mechanism choice. Using transaction data on vacant lots from both auctions and negotiated sales, negotiated transactions were found to yield higher prices.

1 Introduction

In recent years dramatic changes in U.S. real estate and financial markets have lead to rising levels of defaults on residential and commercial mortgages, the insolvency of many financial institutions with deposit insurance, and the takeover of these institutions by the Federal Deposit Insurance Corporation and the Resolution Trust Corporation. An unintended result of these changes finds the federal government one of the largest property holders in the country: as of March 30, 1990 the RTC held 35,908 properties with a book value of \$14.5 billion from failed thrift institutions.¹ An additional \$159.9 billion of thrift assets is under RTC management at 350 sick institutions in conservatorship that the RTC has not yet closed or sold. If the assets at these 350 troubled S&Ls have the same incidence of problem real estate loans as the S&Ls already liquidated, the RTC could eventually control a further \$55 billion (book value) in real estate.

In attempting to return these properties to private ownership, the government must select an approach for the sale of these properties. The FDIC and the RTC have tried both conventional means through negotiated sales and auctions to dispose of their properties. However, with few exceptions, there has not been a careful examination of the comparative efficiency of these alternative market mechanisms.

A formal comparison of these two disposition alternatives must explicitly account for holding costs. Each day the property is not in the private sector, there is not only a carrying cost (in the form of maintenance, interest, depreciation, and property taxes) but also a social cost. The annual holding cost for commercial properties can be as high as twenty percent of their appraised value.² The essential element of an appropriate selling strategy is the tradeoff between timely disposition and obtaining a "fair" price.

This paper models the behavior of a representative buyer and seller who seeks to buy or sell one property. The seller's problem is to determine the optimal method of disposition, either through a search market transaction or via an auction. His decision is dependent on the buyer's participation decision.

¹ Data on RTC property holdings are taken from the May 23, 1990 report of the RTC Oversight Board to the Senate Committee on Banking, Housing, and Urban Affairs.

² Wall Street Journal, "Bankers Are Resorting To Gimmicks to Sell Foreclosed Real Estate", May 30, 1991.

Since in this model buyers can freely choose their mechanism, their decision will affect the seller's choice which in equilibrium must also affect the buyers' initial choice. An interior equilibrium in this market is defined as the existence of participants in both market types, and accordingly the equilibrium concept is Nash.

Despite the fact that there exist two substantial bodies of literature describing both the search market (See for instance Lippman and McCall, 1976, Weitzman, 1979, and Burdett and Judd, 1983 or Rob, 1985 for models of price dispersion) as well as auctions (See the survey by McAfee and McMillan, 1988), there exist few studies which allow for endogenous mechanism choice. Studies which have addressed this issue generally consider the mechanism choice of a monopolist (Arnold and Lippman, 1991 or Harris and Raviv, 1981) or a monopsonist (McAfee and McMillan, 1988). McAfee (1991) has generalized the mechanism choice problem for a wide class of alternatives by considering the dynamic steady state equilibrium of agents' direct mechanism choice. Our analysis differs because we consider many buyers and sellers, and we restrict our analysis to two specific alternatives. This is motivated by the observation that auctions and sale through search markets are the most frequently observed methods of real estate disposition. A major advantage in narrowing our focus is the possibility of determining the effects of variables which are relevant in one market on the outcome of the other. An example of this is in the specification of the bidder valuation distribution in the auction market. Since buyers can freely choose their market, the distribution of valuations in an auction will be influenced by factors such as search cost which determine their reservation price in the search market. Similarly, a seller's holding cost will also influence the equilibrium number of sellers who will sell their property at auction. Historically, both the valuation distribution and the number of objects auctioned has been treated as exogenous in auction models. Within search or price dispersion models, Bester (1988) proposed a model of price dispersion whereby buyers have an outside option when they negotiated the price with the sellers. Our model differs since we are considering the initial market choice of the agents.

We explore a testable empirical implication of our model. We attempt to determine whether or not there

are any systematic price differences attributable to the method of sale. Ashenfelter and Genesove (1992) documented the result that in condominium markets, auctions in general resulted in higher prices. Lusht (1990), using Australian data documented a similar affect.³ Our empirical model differs from Lusht since our data are based on contemporaneous transactions of different properties as opposed to comparing the winning bids which subsequently "fell through" with the negotiated prices of a backup buyers. Our study differs from Lusht's since we restrict our analysis to vacant lots in this country. Using vacant lots allows us to specify parsimonious hedonic regression, thereby reducing the possibility of omitted variable bias in our estimates. We found that vacant lot prices in the search market resulted in higher prices than comparable properties sold at auction. In the next section, we provide a brief overview of the model and section 3 describes the model. The empirical model is presented in section 4.

2. Model Description

Each of the N buyers wishes to purchase one property; the M sellers each have one property to sell. We assume that the M properties are identical and consider the case where $N > M$. All agents are risk neutral, and each optimizes with respect to both his choice of mechanism and his behavior within the selected mechanism. Once an agent selects his mechanism, he is committed to his choice: switching is precluded. As noted in Figure 1, n and $n^* = N - n$ denote the number of buyers in the search and auction market respectively. Similarly, m and m^* are the number of sellers in the search and auction market.

The N buyers form common conjectures about the number of sellers who will participate in each market. Conditional on his belief, each of the N buyers determines his expected profit from each alternative. Within each market, each buyer announces a signal which summarizes his optimal behavior given his market choice. These signals determine his allocation and in the search market, also their likelihood of locating

³ A more recent study by Lusht suggest that the premium is dependent on the strength of the market at the time of the transaction. He finds that there may exist a premium for negotiated sales in slow or less active markets.

a trading partner. Let the expected profit for a buyer with search cost s who participates in the search market be $\Pi_b^s(r^s, n | m, s)$ and for auctions $\Pi_b^a(b^a, n^* | m^*)$. In the search market, r^s is his reservation price which summarizes his optimal strategy under costly search, and in the case of auction b^a is his bid. Given that buyers can freely choose their mechanism, an equilibrium exists if no buyer can benefit from switching to the other mechanism. In the nondegenerate case, there exists a marginal buyer who is indifferent between the two choices such that for him, $\Pi_b^s = \Pi_b^a$.

The M sellers face a similar choice, and given their belief about n and n^* , the sellers must choose the method to sell their property. As in the buyers' case, the seller's decision is determined by their respective expected profits in each market. Equilibrium in the search market is characterized by price dispersion with the sellers choosing their offer or quoted price for their property. Buyers are price takers; thus upon a favorable match, trade occurs at the seller's quoted or offer price. In an auction the seller joins an existing pool of sellers and initiates a sequential multiple-object auction with the seller's allocation dictated by the rules of the auction. Upon a sale, a proportion θ ($0 < \theta < 1$) of the auctioned price is paid to the auctioneer by the seller. An equilibrium in the seller mechanism choice exists if (a) each seller, conditional on his market choice and his belief, cannot benefit from deviating from his strategy and (b) the beliefs of the buyers and the sellers are consistent with actual participation. Under certain conditions, m and m^* , the equilibrium number of sellers in each market can be determined.

3 Search and Auction Market Equilibrium

In this section, we will use a variant of Rob's (1985) model of price dispersion to describe the search market equilibrium. In each period t , the pool of sellers is randomly matched with a pool of n buyers, each with varying reservation prices. Due to the fixity of real estate, trade is decentralized and even though the buyers know the distribution of quoted prices, they are uninformed as to the location of specific

properties and their prices. Realizing that the buyer's search is costly, the sellers post varying prices for their property and for a given distribution of search cost, there exists a corresponding distribution of reservation prices. Since in equilibrium the distribution of reservation prices is dependent on the quoted price distribution which is dependent on reservation prices, an equilibrium in the search market is defined as the existence of a quoted price distribution which is consistent with sellers' expected profit maximization and the buyers following a sequentially optimal search strategy. In this model both n and m are endogenous and the only datum is the search cost distribution.

Each of the m sellers selects an offer price p which maximizes his expected profit in the search market. Let $F(p)$ be the eventual distribution of offer prices, and let s denote the cost to the buyer each time he samples from $F(p)$.⁴ The buyer's optimal search strategy is characterized by his reservation price r which is the solution to (Weitzman, 1979 and Lippman and McCall, 1976):

$$H(r) \equiv \int_0^r F(x)dx = s \quad (1)$$

The reservation price is the buyer's expected gain from embarking on an optimal search strategy. For a given reservation price r , the buyer will reject all sellers whose $p > r$ while accepting all $p < r$. Since r is a monotonically increasing function of s , there exists a distribution of reservation prices for a given distribution of search costs. Let $Q(s)$ and $G(r)$ be the distribution of search cost and the resulting reservation price distribution, respectively. We can also express their relationship by noting that $G(r) = Q(H(r))$. Thus a buyer with search cost $H(r)$ can only trade with sellers who quote a price less than or equal to r . Conversely, a seller who posts a price of p will only attract those buyers whose search cost is larger than $H(r)$. We will make use of this relation in determining buyer participation.

⁴ To avoid dynamic search strategies, we assume $F(p)$, the distribution of quoted prices is unchanged (or that buyers perceive that $F(p)$ is static) for the duration of the buyer's search. This may be supported by a steady state assumption that there exist a continuum of new sellers who enter the market in each period who are of the same type as the ones who exit such that $F(p)$ does not change.

The m sellers observe $G(r)$ and each sets their quoted price to maximize their expected profit. The choice of p determines the seller's expected revenue as well as his expected holding cost. His choice of p involves a trade-off between having a low probability of realizing a high price and setting a low price which would increase the probability of its realization. The seller's selection of p also determines his expected time on the market and therefore his expected holding cost. By increasing his offer price, the group of feasible buyers becomes smaller, and with random matching the likelihood of an expedient sale is decreased. Thus a seller who sets a high price will likely anticipate his property not selling for a longer period of time and, therefore will incur a high holding cost.

Let k be the common per period holding cost, and let matching between buyers and sellers occur over t periods with one match per period. Since a successful match at time t implies the seller was unsuccessful in his previous $t-1$ matches, t has a geometric distribution with parameter p which is the probability of matching favorably. A seller with a quoted price of p can only trade with buyers with a higher reservation price. Thus the probability of a successful match $p = 1-G(p)$. The expected holding cost of a seller who selects a price of p is therefore $\frac{k}{1-G(p)}$ which is increasing in p .⁵ Using the derivation in Rob (1985) and our holding cost assumption, the seller's expected profit function is:

$$\Pi_s^s(p) = p \int_p^{\infty} \frac{g(r)}{F(r)} dr - \frac{k}{1-G(p)} \quad (2)$$

The first term is the seller's expected revenue upon selecting p . For a given p , the probability of meeting a buyer with a higher reservation price is the term in the integral which is decreasing in p . The second term is his expected holding cost. A dispersed price equilibrium exists in the search market if there exists a distribution of offer prices $F(p)$ such that Π_s^s is maximized and is identical for all p in the support of $F(\cdot)$.

⁵ This is consistent with more common notions of market liquidity (Lippman and McCall, 1986).

We can now describe the optimal bidding and allocation rules within the auction market. We consider the case of an independent private values auction: each bidder's valuation is based on personal preferences and is independent of the valuations of others. To determine the price which the buyer expects to pay if he participates in an auction, we assume the m^* identical properties will be sold by a first price discriminatory sealed bid multiple-object auction (Vickery, 1961 and Weber, 1983). In this auction each bidder submits a sealed bid for one of the m^* properties. The m^* highest bidders receive one property each paying a price equal to their bid. We consider the case where $n^* \geq m^*+1$, that is, there is at least one more bidder than there are objects to be sold.⁶ It has been shown by Weber (1983) that for risk neutral bidders with independent private values, a symmetric equilibrium bidding strategy in this auction is for all bidders to bid the expected m^*+1 st order statistic of the bidder's valuation distribution.

Consider a representative buyer who given his search cost and knowledge of $F(p)$, the offer price distribution, determines his reservation price to be r if he participates in the search market. Since his reservation price represents his expected gain or the expected price he will pay from participating in the search market, r represents his opportunity cost of participating in an auction. We therefore let r be his valuation of the property if he participates in an auction and analogously define $G(r)$ to be the distribution of such valuations.⁷ In a multiple m^* object discriminatory first price sealed bid auction the bidders with the m^* th highest valuations will receive the good paying their bid $E[x_{(m^*+1)}]$ where $x_{(m^*+1)}$ is the m^*+1 highest order statistic of the sample of n^* buyers drawn from the distribution $G(r)$.⁸ Since all

⁶ It is important to note that the $n^* \leq m^*+1$ case cannot support an equilibrium since all bidders will bid 0 for the m^* properties in the absence of a reserve price (which we omit in this model for tractability). It would not be rational for sellers to participate in such an auction and an equilibrium cannot exist. It is however rational for $n^* \geq m^*+1$ in equilibrium because each bidder's rational bidding strategy is conditional on his valuation being larger than the m^*+1 highest valuation.

⁷ Even though the buyers may have i.i.d. search cost, the resulting distribution of valuations may not be i.i.d. because they are determined by observing a common offer price distribution. Since i.i.d. valuations are required for much of the auction bidding results used in this paper, we assume that this condition holds.

⁸ The expectation is taken conditional on $r > x_{(m^*+1)}$, the bidder's valuation being higher than the m^*+1

bidders will bid the same amount, $(1-\theta)E[x_{(m^*+1)}]$ also determines the sellers' expected revenue from selling in an auction after the payment of the commission θ .

For the N buyers, each determines his reservation price given their respective search cost s and their conjectures about m and m^* . Buyer i will only bid in an auction if his expected gain from doing so is greater than his expected gain from participating in the search market. Thus for a m^* multiple-object auction, only buyers with $r_i > E[x_{(m^*+1)}]$ will participate in the auction. Since a buyer's reservation price is an increasing function of his search cost s , the availability of an auction as an alternative results in buyers with high search cost participating in auctions and those with low cost participating in the search market.

For a continuum of buyer types, there exists a marginal buyer with a reservation price of $\bar{r} = E[x_{(m^*+1)}]$ who will be indifferent between the mechanisms. Assume that the same equality holds for the marginal buyer in the discrete case. $G(\bar{r})$ approximates the proportion of buyers with reservation prices lower than \bar{r} . $NG(\bar{r})$ is approximately equal to the number of buyers who will be in the search market. Equilibrium in buyer participation is therefore $n = NG(E[x_{(m^*+1)}])$ and $n^* = N(1-G(E[x_{(m^*+1)}]))$.

A similar equilibrating condition can be obtained for the sellers. The distinguishing feature of sellers is that in an equilibrium characterized by price dispersion, all sellers have identical expected profits which over a certain region of prices may not be sensitive to the number of sellers who choose to sell their property in the search market. However, since the revenue obtained in the multiple-object auction is a decreasing function of the number of goods being sold, we can, under certain assumptions, equate the common expected profits to his profits in an auction to determine the number of sellers.

Using our previous notation, $\Pi_s^s(p,k,m|n)$ is the expected profit for a seller who quotes a price p , has a holding cost of k who must compete with $m-1$ other sellers given his belief that there will be n buyers who highest valuation. For notational convenience, we suppress this conditioning argument. More formally,

$$E[x_{(m^*+1)} | r > x_{(m^*+1)}] = \frac{n^*!}{m^*!(n^*-m^*-1)!} \int_a^b xg(x)G^{m^*}(x)(1-G(x))^{n^*-m^*+1} dx.$$

will participate in the search market. Similarly, $(1-\theta)\Pi_s^a(m^*|n^*)$ is the seller's expected profit from participating in an m^* object auction with n^* bidders. The following proposition determines a condition which would give rise to an interior equilibrium number of sellers in each market.

Proposition 1

An equilibrium m^* exists if $(1-\theta)\Pi_s^a(1|n^*) > \Pi_s^s(p,k,M-1|n)$ for a given n^* .

The above condition essentially forces the seller's expected profit in an one object auction to be greater than his profits in the search market populated by $M-1$ sellers. With a one object auction, $\Pi_s^a(1|n^*)$ is simply $E[x_{(2)}]$, the expectation of the second order statistic when there are n^* buyers. Since buyers with high search cost attend the auction, the above condition will in general hold. To ensure an interior optimum with nonempty participation in each market, we must also ensure that $(1-\theta)\Pi_s^a(M-1|n^*) < \Pi_s^s(p,k,1|n)$ or that being a monopolist will yield higher expected profits than a seller who participates in an $M-1$ object auction. Since sellers in the search market by assumption know the distribution of reservation prices, a monopolist can charge the maximum reservation price and with probability 1 be matched with that buyer. Thus the monopolist's expected profit is $E[x_{(1)}]$, the expectation of the first order statistic which is required to be larger than $(1-\theta)E[x_{(M-1)}]$, the amount he would have received by selling at auction to the group of self selected high cost buyers. Given these two conditions, the best response for the $M-1$ sellers given that the M th seller has selected mechanism j is for them to join the M th seller in j . Since the order statistic $E[x_{(m)}]$ is monotonically decreasing in m for a given n , there exists an m^* whereby each seller cannot benefit from deviating from his mechanism choice.⁹

The optimal n^* was derived based on a (common) conjecture that m and m^* sellers will participate in the search and auction market and conversely, an optimal m^* is defined conditional on sellers' beliefs about the

⁹ We can allow for the degenerate case of 0 participation in one mechanism by replacing the strong inequality conditions by weak ones.

buyer's choice. An equilibrium in mechanism participation is said to exist if each group's beliefs are consistent with the actual equilibrium values attained by each group. In essence, an equilibrium n^* and m^* can be determined by simultaneously solving the marginal bidder's between market equilibrium condition and the similar condition for the sellers. It is clear from the expressions involved that in the absence of specific distributional assumptions, a closed form expression for the optimal number of participants cannot be determined.

3.1 A Simple Numerical Example

In this section, we will attempt to derive an expression for the equilibrium n and m values by making specific distributional assumptions about some of the variables. Let the distribution of reservation price $G(r)$ be uniform on the interval $[0,1]$. The expected value of the m th order statistic of a sample of size n drawn from $G(r)$ is $E[x_{(m)}] = \frac{n-m+1}{n+1}$. For the marginal buyer with reservation price \bar{r} , $G(\bar{r})$ represents the proportion of buyers whose $r_i \leq \bar{r}$. From before, we see that $n^* = N[1-G(\bar{r})] = N[1-\bar{r}]$ or $\bar{r} = 1 - \frac{n^*}{N}$. Equating $E[x_{(m^*+1)}] = \bar{r}$ for the marginal buyer and solving for n^* , we see that

$$n^* = [(1+4N(m^*+1))^{\frac{1}{2}} - 1]/2 \quad (3)$$

n^* is the number of bidders who will attend the auction given that there are N buyers and m^* objects to be auctioned. Figure 2 is a graph of this function for $N = 100$ for various values of m^* . It can be seen that $n^* > m^*$ as required implying that there will always be more bidders than objects auctioned. For example it can be shown that if one object is auctioned, there will be 13 bidders and for 10 objects, there will be approximately 32 bidders.

To determine the number of sellers who will participate in each market, we need to assume a distribution for the offer prices. From (2) and using our previous assumption of a uniformly distributed reservation price, the expected profit function for the seller is:

$$\Pi_s^s(p,k,m|n) = p \int_p^{\bar{r}} \frac{1}{F(r)} dr - \frac{k}{1-p} \quad (4)$$

Since only buyers with $r \leq \bar{r}$ will be in the search market, the distribution of quoted prices $F(p)$ must also be bounded by \bar{r} . If we also let $F(r)$ be uniformly distributed within the bound $[0, \bar{r}]$ where from before, $\bar{r} = 1 - \frac{n^*}{N}$, we obtain the following expression for the seller's expected profit function¹⁰ :

$$\Pi_s^s(p,k,m|n) = p \left(\frac{N-n^*}{N} \right) \ln \left(\frac{N-n^*}{pN} \right) - \frac{k}{1-p} \quad (5)$$

Equating this with his profits from auction we arrive at the following expression for the number of sellers who would participate in the auction.

$$m^* = n^* + 1 - \frac{(n^*+1)p}{(1-\theta)} \left(\frac{N-n^*}{N} \right) \ln \left(\frac{N-n^*}{pN} \right) - \frac{(n^*+1)k}{(1-\theta)(1-p)} \quad (6)$$

It can be shown that $m^* > n^*$ for $p \in [0,1]$ thus satisfying our requirement. The overall equilibrium is achieved by simultaneously solving (3) and (6) for n^* and m^* . A simulation of the equilibrium is provided in Figure 3 where expressions (3) and (6) are graphed. We assume that there is a 20% holding cost and consider a $p = .1$. Thus in a market with 100 buyers and 90 sellers, in equilibrium 79 bidders will bid for 62 of the goods at auction while 21 low cost buyers will participate in the search market for 28 goods.

There are certain testable empirical implications which arise from the model. An observable

¹⁰ To be consistent with our model, a uniform distribution for the reservation prices over the interval $[0,1]$ and a uniform offer price distribution defined over the region $[0,b]$ where $b < 1$ is consistent with the search cost distribution $Q(s) = (2bs)^{\frac{1}{2}}$. This can be shown by solving for r in (1) using the search cost distribution.

relationship is the difference between auction prices and prices in the search market. The following proposition states this relationship based on our reservation price distribution assumption and assuming a holding cost of 0 for the sellers.

Proposition 2 Set $k = 0$ and assume the reservation price has a uniform distribution over the interval $[0, B]$ where B is the bidder's bid. Then $E[p] = \frac{2}{3}(1-\theta)B$.

Proof: Using our previous argument that only buyers whose reservation prices are less than B will participate in the search market and our equilibrium condition, the seller's equilibrium profit condition is:

$$\frac{(1-\theta)B}{p} = \int_p^B \frac{g(r)}{F(r)} dr \quad (7)$$

Differentiating both sides with respect to p we see that $F(p)$, the distribution of offer prices will have

the form $F(p) = \frac{g(p)p^2}{(1-\theta)B}$. Using our uniform reservation price distribution assumption, it follows that

$$E[p] = \int_0^B \frac{2x^2}{[(1-\theta)B]^2} dx = \frac{2}{3} (1-\theta)B. \quad \blacksquare$$

We see that in the absence of search cost, the mean price offered in the market will be less than prices at auction by one third. The analogous relationship with holding cost is considerably more complicated and we can at this stage only offer some conjecture. With holding cost the distribution function for the offer prices will have the following form:

$$F(p) = \frac{p^2(1-p)^2}{(1-\theta)B(1-p)^2 + k(1-2p)} \quad (8)$$

When $k=0$, the above expression reduces to the case considered in proposition 2. (8) is a proper distribution function only over the range $[0, .5]$ and it is clear from inspection that $F(p)$ with holding cost

will be smaller at low offers and will increase as the prices increase. There will be, therefore, a corresponding decrease in the number of low offer prices. Since there will be proportionately less lower price offers, the expected search market price will be larger than proposed in proposition 2. In the next section, we provide some empirical evidence of this relationship.

4. Empirical Test

In this section we investigate how the method by which undeveloped land is sold affects its price. In particular, we use hedonic regressions to compare the prices of vacant lots sold through conventional means and through auctions. Limiting our study to undeveloped land allows us to specify a parsimonious hedonic model, thereby reducing the possibility of omitting important attributes. According to our hedonic model, auction prices are significantly lower.

The auction data analyzed in this study come from three auctions held between April and August, 1991, and the vacant, single-family housing lots are located in the Austin, Texas metropolitan area. The 125 winning bids range from \$400 to \$39,000. We deleted from the sample observations where there are multiple lot sales at one auction price (16 lots) and lots with sizes greater than three acres (10 lots), because these large lots may represent an opportunity for further subdivision. After these deletions, the auction sample consists of 99 observations.

The sample of negotiated sales is obtained from the Austin Board of Realtors Multiple Listing Service (MLS). We search MLS sales over the sample period for undeveloped lots sold through a negotiated sale procedure and find 149 observations. In those negotiated sales there are 18 observations which are sold with seller financing at a below-market interest rate. We did not include these sales in our analysis because the sales price may reflect not only the value of the lot, but also the value of the cheaper financing. Similar to the auction sales, we delete negotiated multiple lot sales (21 lots) and large lots over three acres (6 lots), leaving a negotiated sample of 104 lot sales.

Table 1 presents the results of our empirical tests. In our regressions the sales price of the lot is the dependent variable, and the sales procedure is a 0-1 explanatory variable with auctions sales having a value of 1. To recognize the influence of other factors on lot prices, we include additional explanatory variables representing the size of the lot (square feet of land) and its location within the Austin metropolitan area (either the distance in miles from the lot location to the Austin central business district or 0-1 variables representing one of five regions within the area). To correct for the wide distribution of the sales price and size variables, additional regressions are specified with the natural log of these variables.

In all four regressions, the explanatory variables have their anticipated signs and, except for some of the area variables, are significant at the 1% level. The auction variable has a negative coefficient indicating that the properties disposed through auction sold at discounts relative to the prices that would have been obtained in a negotiated sale, all else held constant. The average auction discount is from \$13,363 to \$16,060 per lot based on these regression results. This discount is approximately 40% of the mean sales price of lots in the sample. This result appears to conflict with Ashenfelter and Genesove's (AG) study of auction and face-to-face bargaining prices of condominiums in New Jersey. In their study, the winning bids were for units "hammered down" at auction which later "fell through" or were not sold at the bid. These were compared with prices negotiated with a backup buyer. A backup bidder is usually an unsuccessful bidder who is given the first opportunity to negotiate for the property should the highest bidder renege on his bid. Such a buyer is clearly in a superior bargaining position if contacted and their lower negotiated price will reflect this advantage. This relationship does not exist in our data since we use data which were contemporaneously traded in both the auction and the conventional market.

5. Conclusion

The method of disposition of real estate assets is explored in this paper. The two most commonly used

are through an auction or via conventional means. By allowing buyers and sellers to freely choose, our model attempts to determine the equilibrium number of participants within each market and the expected price observed in each market. It is argued that the availability of an auction as an alternative has the result of high search cost buyers attending auctions and buyers with low search cost participating in the search market. It is also shown that in the absence of seller holding cost, prices on average will be lower than prices obtained at auction by one third. It was empirically determined that after adjusting for attribute differences, vacant lots sold in the search market resulted in prices which are substantially higher than similar lots which were sold at auction. This result appears to contradict previous empirical findings which resulted in auctions commanding a higher price. Clearly, more analysis is required to reconcile this difference.

References

- Arnold, M. and S. Lippman, "Optimal Selling Institutions: Auctions Versus Sequential Search", Working Paper, Anderson Graduate School of Management, UCLA, 1991.
- Ashenfelter, O. and D. Genesove, "Testing for Price Anomalies in Real-Estate Auctions", *American Economic Review Papers and Proceedings*, May, 1992, pp. 501-505.
- Bester, H., "Bargaining, Search Costs and Equilibrium Price Distributions", *Review of Economic Studies*, 1988, pp. 201-214.
- Burdett, K. and K. Judd, "Equilibrium Price Dispersion", *Econometrica*, 51, 1983, pp. 955-969.
- Harris, M. and A. Raviv, "A Theory of Monopoly Pricing Schemes with Demand Uncertainty", *American Economic Review*, June, 1981, pp. 347-365.
- Lusht, K., "Auctions Versus Private Sales of Houses: A Description and Empirical Analysis of the Melbourne, Australia Market", working paper, College of Business Administration, The Pennsylvania State University, May, 1990.
- Lippman, S. and J. McCall, "The Economics of Job Search: A Survey", *Economic Inquiry*, 14, 1976, pp 347-368.
- "An Operational Measure of Liquidity", *American Economic Review*, 76, 1986, pp. 43-55.
- McAfee, R. P., "Mechanism Design by Competing Sellers", Working Paper, Department of Economics, University of Texas at Austin, 1991.
- and J. McMillan, "Auctions and Bidding", *Journal of Economic Literature*, 25, 1987, pp 699-738.
- and J. McMillan, "Search Mechanisms", *Journal of Economic Theory*, 44, 1988, pp 99-123.
- and D. Vincent, "The Afternoon Effect", CMSEMS discussion paper No. 961, Northwestern University, 1991.
- Rob, R., "Equilibrium Price Distributions", *Review of Economic Studies*, 1985, pp 487-504.
- Weber, R., "Multiple-Object Auctions", in *Auctions, Bidding, and Contracting: Uses and Theory*, edited by Engelbrecht-Wiggans et al., 1983, pp 165-191.
- Weitzman, M., "Optimal Search for the Best Alternatives", *Econometrica*, 47, 1979, pp 641-654.
- Vickery, W., "Counterspeculation, Auctions, and Competitive Sealed Tenders", *Journal of Finance*, 16, 1961, pp 8-37.

Figure 1

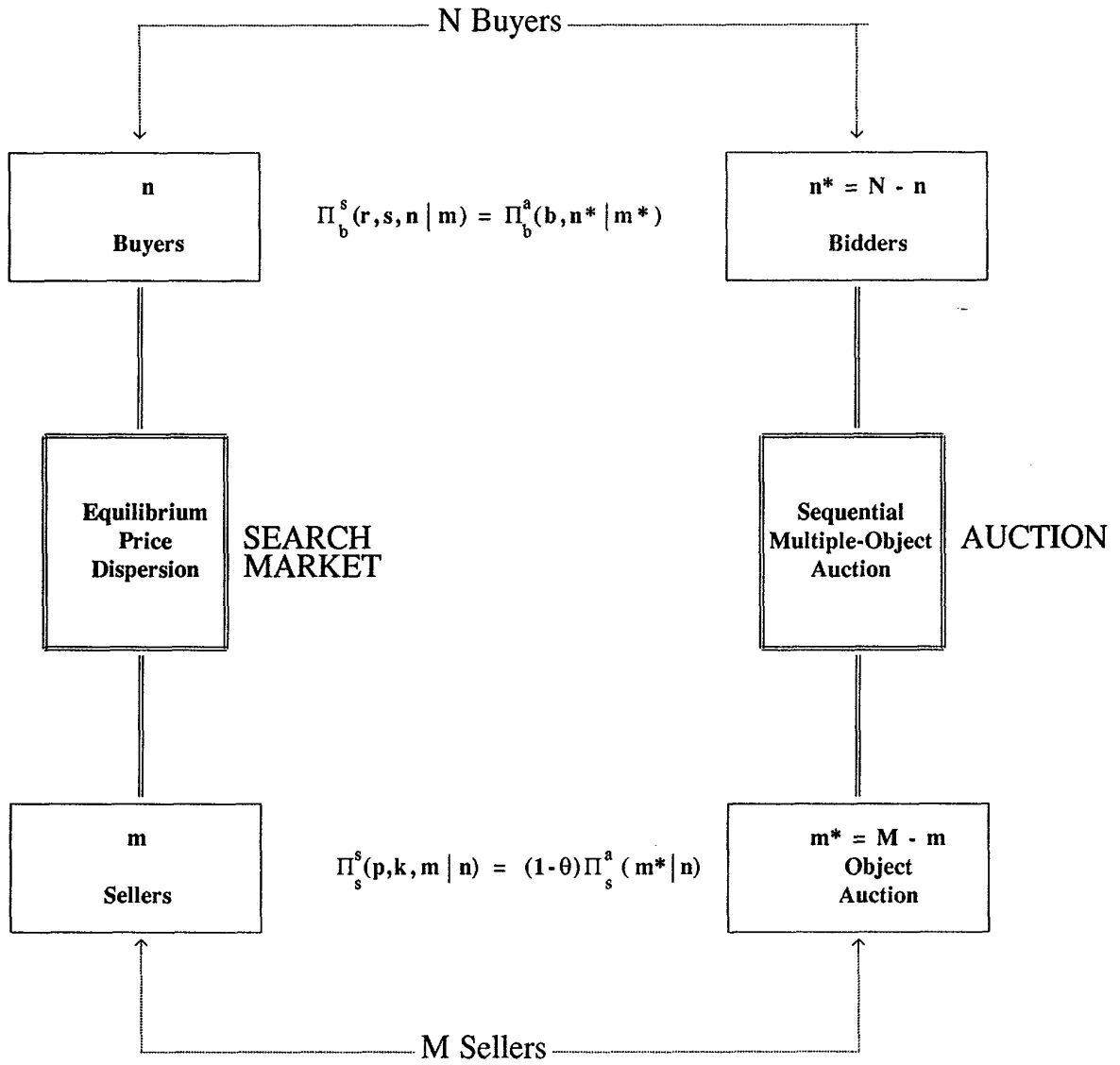


Table 1
Regression Results

(t-statistics in parenthesis)

Dependent Variable	Price	Price	Log(Price)	Log(Price)
Intercept	32492.06 (1.043)	1653.61 .0573	5.3169 (6.047)	4.3611 (5.829)
Log(Square Feet)			.5384 (6.329)	.4628 (6.365)
Square Feet	.6249 (5.555)	.5525 (5.513)		
Distance to CBD	-961.213 (-3.511)		-.0485 (-6.254)	
Auction (Auction = 1)	-13363.38 (-2.841)	-16056.99 (-3.556)	-.5628 (4.068)	-.5755 (-4.745)
Area 1		48997.76 (5.145)		1.924 (7.758)
Area 2		11468.62 (1.203)		1.115 (4.514)
Area 3		13326.45 (1.546)		.757 (3.395)
Area 4		7103.96 (7.356)		.199 (.799)
R ²	.2609	.3706	.4085	.5392
N	202	203	202	203

Figure 2
Plot of n^* for a given m^* ($N=100$)

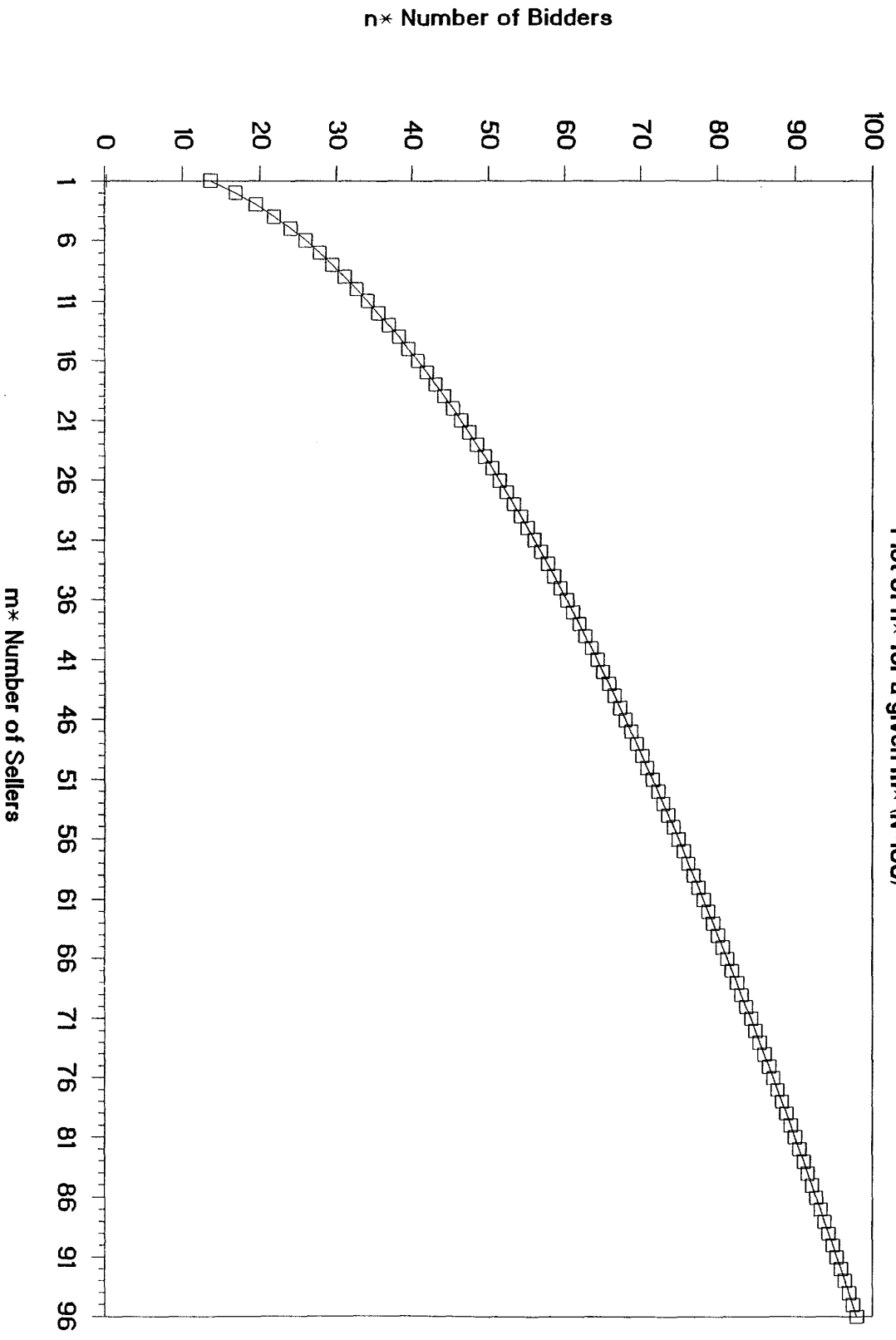


FIG 3 - Equil. # of Bidders and Sellers

($k=2$, $\Theta=9$, $N=100$, $P=1$)

