INFORMATION ISSUES IN REAL ESTATE

SEOW ENG ONG and GERALD R. BROWN
Department of Real Estate
National University of Singapore

ABSTRACT

Real estate has often been regarded as information inefficient due to its heterogeneity and diversity. While the academic literature has recognized the role of information in real estate, the application of game theory to information problems has been somewhat limited. In particular, we focus on adverse selection and moral hazard. Examples of such strategic uncertainty are provided to illustrate these issues and the potential solutions.

Keywords: Strategic uncertainty, adverse selection, game theory, information asymmetry, moral hazard, institutions.

INTRODUCTION

Real estate has often been regarded as informational inefficient due to its heterogeneity and diversity. In addition, real estate transactions, unlike those for stocks and bonds, are not made in a central market place where pertinent information is readily reflected in the price. Consequently, information is an important element for decision-making and evaluation in real estate. While the academic literature has recognized the role of information in real estate, the application of game theory to information problems has been somewhat limited. For instance, the focus in the application of game theory has tended to be on the principal-agent relationship in real estate agency and in auctions. Many other informational issues in real estate have not been adequately addressed, although in recent years, academic papers have started to emerge.

This paper highlights information issues in real estate. The next section briefly explains the concepts of strategic uncertainty, game theory, information economics and types of games. Following that, information issues in real estate are discussed. Finally, several instances where real estate participants operate under imperfect information are discussed and the game theoretic solutions are highlighted.

GAME THEORY AND INFORMATION ECONOMICS

Game Theory

Game theory is the study of the behavior of decision makers (players) whose decisions affect one another (Aumann, 1989). Decision makers are assumed to be rational and able to reason strategically. In other words, under strategic uncertainty, decision makers pursue well-specified exogenous objectives and take into account their knowledge and expectations of other decision makers' behavior (Osborne and Rubinstein, 1994).

One of the earliest works in game theory is Cournot's 1938 model of duopoly where two firms have to consider the quantity that the rival firm is producing in deciding their own production. However, it was only in 1944 with John von Neumann and Oskar Morgenstern's seminal work *The Theory of Games and Economic Behavior* that game theory became accepted as a major field of study in economics. In the 1950s, John Nash laid the framework for general non-cooperative theory and the Nash equilibrium. The Prisoner's Dilemma, attributed to A. W. Tucker, is perhaps the most widely used example of the Nash equilibrium in a non-cooperative setting. Readers interested in the historical development of game theory are referred to Aumann (1989).

Information Economics

Information economics is a specialized branch of economics that deals with asymmetric or incomplete information. Classical economic theories assume that market participants possess complete information about the variables that affect their decisions. In virtually all economic and business situations, this assumption is invalid. Frequently, decision-makers operate under environments where some parties have access to better information than others, hence, asymmetric information.

While information economics encompasses a broad spectrum of topics and variations, this paper focuses on the special topics of adverse selection and moral hazard. An adverse selection problem occurs when one party to a transaction possesses information pertinent to the transaction that is relevant but unknown to the other party. Moral hazard is a problem when one party to a transaction may undertake certain actions that cannot be observed by the other but will affect the latter's outcome. Examples of and solutions to such information problems will be illustrated in a later section.

Although game theory and information economics use mathematics to express ideas formally, the objective of game theory is to understand the behavior of interacting decision-makers (Osborne and Rubinstein, 1994). For the purpose of this paper, mathematical formulations are avoided; rather intuitive explanations are given to illustrate game theoretic concepts and ideas.

Types of Games

A game is simply a description of strategic interactions among many decision makers (players), including the constraints on players' actions and their interests (Binmore, 1992; Binmore & Dasgupta, 1986; 1987). Games can either be static or dynamic; and they can either involve complete or incomplete information. A static game is one where all players move simultaneously while a dynamic game or sequential-move game allows one player to move first, followed by the others. A game with complete information means that all players know the payoffs (outcomes) of other players, while a game with incomplete information means that players do not know the payoffs of other players.

Examples of static games with complete information are the Prisoner's Dilemma, Cournot and Bertrand models of duopoly, and final offers of arbitration. In the Prisoner's Dilemma, two prisoners have to simultaneously decide whether to confess. Each prisoner knows that if he/she confesses while the other does not, he/she will be

given a lighter sentence. Since the payoffs (outcomes) of the prisoner's actions are known, this is a game of complete information.

The Stackelberg duopoly model is an example of a dynamic game with complete information. The dominant firm moves first, followed by the subordinate firm. Take for instance, changes in prime lending or mortgage rates. Typically, one bank will take the lead in changing interest rates and the other firms will subsequently follow. Similarly, when one developer raises the price of its units, others will soon do likewise.

Static games with incomplete information are best illustrated by the first-price, sealed-bid (FPSB) auction. In the FPSB auction, bidders submit their bids simultaneously in sealed form, so that others cannot see what the bid is and the highest price (bid) wins the auction. Each bidder has his/her own valuation of the object under auction, but all bidders have to act simultaneously without knowing the other bidders' valuations. In addition, developers repeat their participation in auctions, or take part in what is referred to as repeat games.

Dynamic games with incomplete information are richer in that decision makers (players) have to move sequentially without complete information. A good example is the job-market signalling game. The problem is that the employer does not know the quality of the potential employee (hence incomplete information). The solution is that the job seeker can use his/her education choice as a signal that he/she possesses high quality. This paper deals primarily with dynamic games with incomplete information.

Information Asymmetry

Information asymmetry occurs when information is incomplete or when one party has better information than the other party. There are two main situations of information asymmetry – adverse selection and moral hazard. Adverse selection arises when one party does not know and observe the other party's type or characteristics. Rasmusen (1994) describes adverse selection as when "the agent has private information about his type or the state of the world before he agrees to a contract." Kreps (1990) defines adverse selection thus – "If in a transaction one side but not the other side knows the quality in advance, the other side must worry that it will get an adverse selection out of the entire population." Alternatively, Kreps describes adverse selection "where one party to a transaction has available information that a second party lacks."

The job-marketing signaling game mentioned earlier is an example of adverse selection. The employer (principal) is unable to ascertain the applicant's productive ability (or type), and is thus making an adverse selection. Other examples are: the purchase of a second-hand car (the buyer does not know the quality of the second-hand car); an insurance contract (the insurance company does not know the health of the insured), and a credit card application (the credit card company does not know the credit worthiness of the individual applying for the credit card). The consequence of adverse selection is that the pool is no longer random. Applicants of poorer ability are more likely to apply for a job or the less healthy is likely to insure themselves. In the extreme, adverse selection leads to market failure.

Moral hazard, in contrast, arises when the uninformed party cannot observe the other party's actions. Kreps (1990) describes moral hazard as "hidden actions" while

Rasmusen (1994) analyses moral hazard with hidden actions and hidden knowledge or information. Moral hazard occurs when "one party to a transaction may undertake certain actions that (a) affect the other party's valuation of the transaction but that (b) the second party cannot monitor/enforce perfectly" (Kreps, 1990).

Moral hazard is common when the employer (principal) cannot observe the actions of the employees (agents) but the employee's action affect the payoff for the employer. It is sometimes referred to as hidden action. A conflict arises from the fact that the agent and principal's interests differ. However, since the agent knows more, he is likely to favour his interests at the expense of the principal. An agent may take actions inimical to the principal but beneficial to the agent.

The problem is commonplace in marketing situations. Agents bring in revenue for their employer, but should the marketing agent shirk in carrying out his/her duties then the employer's revenue will be adversely affected. The optimal situation is that the employer can fully observe the actions of the agent (to prevent shirking), but when that cannot be achieved, moral hazard arises. Here, the incomplete information is the agent's unobserved actions.

Another example of moral hazard is the subsequent action of an insured person after purchasing an insurance contract. Suppose a person takes an insurance policy on his car. The insured car owner can be careful, thus reducing the chance of an accident, or he/she can be careless, which obviously increases the chance of an accident. The insured car owner's actions are, however, not fully monitored by the insurance company. Hence a moral hazard problem arises. Another example is the shareholders-manager relationship. The manager's action affects the wealth of the shareholders but the latter cannot completely observe the actions of the manager. Hidden actions (or non-actions) taken by the manager may be detrimental to the shareholder, hence moral hazard.

Moral hazard exists in real estate development when a developer advocates going ahead with a project knowing very well that the project is likely to fail. This is because the developer would make profits in the development process, regardless of outcome. James Graaskamp, an early exponent of the notion that "Every expense item in a project budget is a profit centre for someone" notes that "above the line" cash flows are important incentives to do projects regardless of their feasibility or marketability. Developers almost always want to build because they generally have profits during development sufficient to motivate doing the deal. See Jarchow (1991) for more details.

INFORMATIONAL ISSUES IN REAL ESTATE

Many informational issues exist in real estate. For instance, a prospective real estate agent must signal that he/she is more productive in generating and closing sales since the employer faces incomplete information. Likewise, the property manager wants to signal his/her competence to secure a job or to obtain a promotion. While these examples are outright extensions of the job-market signaling game, the pertinent issue is to uncover the effective signals for real estate professionals.

Auctions of properties and land for development are further examples of information asymmetry. A developer who submits a closed bid for land does not know what other bidders would bid. Too low a bid will mean a missed opportunity, but too high a bid may subject the developer to the winner's curse, in that the developer overbid relative to the next highest bidder. In short, bidders operate under imperfect information of what the land is worth to other bidders; more specifically, they face adverse selection. After the authorities award vacant land to the highest bidder in land auctions, concerns arise as to the ability of the developer to complete the project on time and whether corners would be cut. This is a moral hazard problem.

Developers who select contractors based entirely on submitted bids are subject to both adverse selection and moral hazard problems. A developer does not know *a priori* the quality of the contract work and the contractor's reliability when he awards contracts, so adverse selection exists. After selection, the developer may not be able to perfectly monitor the quality of the contractor's work. Attempts to shirk on effort or use inferior materials on the part of the contractor would have a detrimental effect on the developer. Hence moral hazard also plagues the developer.

The informational problems afflicting the developers apply to homeowners too when they engage contractors to renovate their homes. This affliction – exemplified by shoddy workmanship, incorrect specifications, delays in renovation, etc – we suspect, is shared by many homeowners. One remedy to rectify such problems is reputation building on part of builders and developers. A good reputation and track record offer indications of reliability and trust.

On the real estate investment perspective, information issues are pervasive, to say the least. A prospective property investor evaluating projects in developing countries does not know how good the projects will be. For instance, the investor faces adverse selection issues over the parties involved in the development and marketing of the projects. On completion, the investor faces moral hazard problems in the management and maintenance of the projects since some actions (or non-actions) taken by the property manager may not be observable to the investor. Where projects are located overseas, there is another dimension of information incompleteness - the ability of the investor to monitor the actions of the manager could be further diminished.

The price discovery process in searching for the true value for both buyers and sellers is another interesting area where information asymmetry exists. Should a seller list her property or attempt to sell the property herself? Or should she place the property for auction? Which mechanism is more effective in finding a buyer, and at the best price? Should the owner engage a property agent, she encounters adverse selection when she picks which real estate agent to engage, for she does not know how efficient the agent is. Similarly, the seller faces a moral hazard problem for he/she cannot observe the effort level of the agent. The pertinent question is to ascertain the relevant remuneration scheme that would provide the highest incentive for an agent to market a property.

Information issues arise also in the bargaining and negotiation process between sellers and buyers. Both the buyer and the seller have reservation prices. Uncovering the common overlap in these reservation prices is a necessary condition for a successful

transaction; but both the buyer and seller do not have complete information about the other party's reservation price.

Would the appraised value (valuation) for the property be a good guide for buyers and sellers? To some extent, yes, but then the question is how do appraisers assess the true value of a property? In a perfect world, appraisers have full information, so their value should be accurate. However, appraisers also operate in a world of incomplete information and moral hazard. For instance, the appraiser may not be able to detect structural defects in a house that is to be valued. The seller is unlikely to inform the appraiser that the roof leaks or that the house is termite infested. In addition, how does the appraiser update new information from comparable transactions and valuations? How the appraiser arrives at the value of the house is another area of study for the information economist.

A mortgagee who decides to engage an appraiser encounters adverse selection when he picks which agent to engage since he does not know how efficient or capable the agent is. Rudolph (1994) addresses whether bad appraisers will drive out good ones since bad appraisers can claim they are providing a good appraisal. Finch, Fogelberg, and Weeks (1999) argue that appraisers will invest in professional designations to build a long-term reputation. This investment credibly signals that a professionally certified appraiser will provide a good appraisal.

Moral hazard in residential appraisal and lending has been highlighted by Lentz and Wang (1998). If a representative of the mortgagee is compensated based on loans generated, then the mortgagee may put pressure on an appraiser to value the real estate at the price agreed upon by the seller and buyer. On the other hand, a mortgagee concerned about the number of defaults may be more likely to pressure an appraiser to undervalue real estate.

Another example is enbloc or collective sales to better utilize land resources. Enbloc sales in Singapore describe the process whereby owners of under-utilized properties collectively decide to sell to a developer who would redevelop the land to a higher more-intensive use. The key is that all (or a minimum percentage of) owners have to agree to the sale. As such, some owners may decide to hold-out on signing on the dotted line in an attempt to extract larger surpluses. So the developer faces incomplete information not only on the reservation values of the owners, but the hold-out potential as well.

Urban development and planning face informational issues as well; the planning authorities may change the designated land use or building guidelines so that property owners face incomplete information in planning future redevelopments or upgrading. On the other hand, property owners may contravene approved land use, thus the planning authorities need to implement policies to minimize moral hazard.

IMPROVING MARKET EFFICIENCY: SOLUTIONS TO INFORMATION PROBLEMS IN REAL ESTATE

If information issues abound in real estate, how can a better understanding of these issues help us? The answer lies in the insights that theory can provide us in mitigating informational problems. In economic jargon, we say that in the absence of

information asymmetry (where the world is perfect), the first best (optimal or most efficient) case can be achieved. But when information asymmetry exists (in the real world), we attempt to achieve the second best Nash equilibrium such that all relevant parties do the best they can under the circumstances of imperfect information.

In addition, game theory more often than not, unveils and sheds light on policy measures that can address the information issues. Finally, theoretical research into information issues provides the underpinning for empirical research, since good empirical research is guided by theory.

Three examples in which informational problems exist will be highlighted in this section. The purpose is to illustrate how the moral hazard and adverse selection issues create problems for decision-makers and the solutions to these informational problems.

Auctions

Auctions for property and land are increasingly popular in many countries. In Scotland, for instance, property auctions are held where potential buyers submit closed bids. Land auctions are regularly held in Hong Kong, Singapore and Australia. Auctions can be based on open or closed bidding. In an open auction, bidders shout out their bids, usually in ascending order, and the highest bid secures the property. A closed auction, in contrast, requires bidders to submit sealed bids that will be opened simultaneously. A closed auction in which the highest bid secures is also known as a first-price, sealed-bid (FPSB) auction.

It is of no surprise that bidders may overbid, a phenomenon known as the winner's curse. Overbidding can arise from an overly optimistic assessment of the value of the property or land, or from an incorrect estimation of the competitor's valuation. To illustrate this consider two bidders, A and B, in a FPSB auction. Each bidder knows his personal valuation of the property or land, but not the other bidder's valuation. Both bidders seek to maximize profits, which is the difference between the valuation and the bid.

Suppose A and B bid their respective valuations. If so, the bidder with the higher valuation (say A) would win, but A would not have maximized his profits. In fact, A would have zero profits. If A knew B's valuation is lower (but unfortunately he does not), he would have bid just a shade above B's valuation and thereby enjoyed positive profits. So A suffers from a winner's curse by bidding at his valuation. Again, the problem here is one of imperfect information. More precisely, this is a problem of adverse selection because each bidder does not know the other bidders' valuations.

The solution is to derive a Nash equilibrium (Gibbons, 1993) where each bidder formulates a strategy expressed in terms of the other players' strategies, much like the Cournot or Bertrand models of duopoly. A Nash equilibrium is a strategy profile in which each player's part is as good a response to what the others are meant to do as any other strategy available to that player (Kreps, 1990). The optimal Nash strategy for any bidder must solve the problem of maximizing the profits from bidding above the other bids. For further reading, refer to Quan (1994).

Price Formulation

One of the most common methods of valuation relies upon using comparable sales evidence as the basis for estimating the value of similar non-traded property. It has frequently been argued that this approach causes valuation to be backward-looking and as a result the smoothed versions of true market value do not fully reflect current market information. Quan and Quigley (1989; 1991) adopt an interesting game-theoretic approach to the valuation problem. By specifying a price model for the real estate market, they deduce the relationship between market information and transaction prices and ask what optimal strategy should a valuer follow. The job of the valuer is to make use of as much information as possible concerning an observed transaction price in order to estimate the value of a non-traded property. The valuer knows that the transaction price occurs within a price range bounded by the buyer's and seller's threshold prices, and that the transaction price depends also on the negotiating strength of each party.

Given this framework, buyers and sellers play a game in which the payoff is the profit that each will make. As they each want to maximize their respective profits, they will reach a form of non-cooperative agreement, or Nash equilibrium. This Nash equilibrium transaction price can be expressed as a weighted sum of the seller's threshold price and the buyer's threshold price.

The observed transaction price is thus only a noisy or imperfect signal of the true market price. The valuer's job is to use the observed transaction price to estimate the value of a comparable non-traded property. This formulation sets the stage for the appraisal smoothing literature (Quan and Quigley, 1991; Geltner, 1991; 1993) that has become widely-accepted.

Off-Plan Sales

Off-plan property sales is common practice in many countries. Essentially, buyers purchase property units in developments that are yet to be completed, i.e., purchasers buy off-the-plans. Off-plan sales improve cash flow management for the developers, reduce the uncertainty of future payoffs and enable home owners to hedge against rising property prices. In the United States, home buyers often have to commit to buy unbuilt homes if they wish to incorporate their tastes and preferences in the design and construction of their homes. It is also not uncommon for condominium developments in land scarce Singapore and Hong Kong to be completely sold even before construction work begins.

There are some well-known problems associated with off-plan sales. The first problem is that off-plan sales can reduce the incentive for developers/contractors to put in the optimal effort required to complete the development (Ong, 1997). In other words, a moral hazard problem arises when properties are sold off-the-plan. The second problem is that developers may not always honor their off-plan sale contracts and not complete the development as promised. Put differently, purchasers in off-plan sales are prone to an adverse selection problem (Ong, 1999).

The first problem that off-plan sales create a moral hazard problem has been recognized by many practitioners. Razzi (1995), for instance, reports that "buying an unbuilt property is an act of faith" which is often misplaced since "builders could take

shortcuts or make mistakes." Ong (1997) postulates that developers have less incentive to provide quality workmanship if their properties are sold before completion. The reason is that buyers have already entered into contracts and that the quality of workmanship is not immediately known upon the completion of the building. The inability to determine workmanship is the classic unobservability problem in the moral hazard literature. The catch for buyers is that the lower effort translates to a higher probability of intrinsic defects years later.

The challenge is to find solutions to this moral hazard problem. Conceivably, the incentive to shirk from exerting optimal effort can be reduced by (a) defect warranties, (b) building inspections, and (c) restrictions on the extent of off-plan sales. Ong (1997) shows that as long as off-plan sales are permitted, developers would continue to shirk from the optimal level of effort even when they are liable for defect warranty. In other words, defect warranty is unable to achieve the first best case. The extent to which defect warranty can be used to mitigate the disincentive effects of selling prior to completion of the property depends on a benefit-cost analysis. The problem of building defects can be alleviated not only by imposing a longer defect warranty period or more stringent inspection standards, but also by limiting the extent to which developers can engage in off-plan sales. The last suggestion obviously has interesting policy implications.

The second issue is a problem of adverse selection for buyers. To illustrate this problem consider the following incident: A group of Singapore investors institute legal proceedings in August 1997 to force a developer in Beijing to adhere to the terms in property contracts made three years earlier. The investors had purchased 45 units, for which they paid 40% or more of the cost, and signed contracts that stipulated buy-back guarantees. The development was scheduled for completion in December 1995, but was not completed as of 1997. This incident is not unique as several other cases were also reported where buyers of foreign properties ended up with mere pieces of paper and incomplete buildings.

The abandonment of projects after money changes hands illustrates the adverse selection problem for buyers in off-plan sales. Adverse selection occurs because property buyers in off-plan sales are unable to differentiate the good and bad developers. At the risk of oversimplification, a 'good' developer will deliver on the contract and complete the property, while a 'bad' developer may not. The problem is that buyers are not able to differentiate the good developers from the bad. In markets where developers have established track records, this lack of information symmetry is not so much of a problem. However, in markets that are insufficiently mature for developers to acquire a track record or for developers who are new entrants, the adverse selection problem exists because buyers do not know whether the developer is reliable. Such situations confront buyers of properties in new markets, such as China and Indo-China.

Ong (1999) shows that the adverse selection problem is likely to persist when conditions favor a pooling equilibrium where both the good and bad developers find it optimal to presell. However, a separating equilibrium can exist, where good developers opt to finance entirely from bank loans and bad developers presell. Under this equilibrium, the developer's type (or nature) becomes fully revealed, and the adverse selection problem is eliminated. The challenge is to establish the conditions

for such a separating equilibrium to exist. Put differently, the act of refraining from off-plan sales can be used as a signal of the developer's true ability. However, developers would find such a signal to be costly, a finding consistent with other academic work in the signalling paradigm.

Clearly the first best case is for buyers to have full knowledge of the developer's type or ability. But in the absence of first best, the second best solution is for capable developers to incur a costly signal or offer credible guarantees to differentiate themselves.

CONCLUSION

The key premise in this paper is the pervasiveness of information asymmetry in real estate. Hopefully, readers are convinced by now that many real estate issues and situations can be viewed as games with incomplete information. In an idealized perfect world, there are no information issues. More often than not, practitioners deal with the issues and situations the best they can, and move on. This paper suggests that information issues can be analyzed by appealing to a game theoretic framework. Game theory and paradigms in information economics offer Nash equilibria and solutions that are second-best. Sometimes, the first-best or most efficient outcome can be achieved.

The examples provided in this paper serve to highlight specific, and somewhat limited, instances in which informational problems in real estate can be found. The examples are specific because each situation or issue is unique. Real estate is a unique, heterogeneous, long-lived asset involving cross-disciplinary fields, and there are no doubt many more instances where information problems adversely affect market efficiency. The challenge for researchers is to integrate well-established principles in information economics with the unique features in real estate so as to shed new light on these important problems.

An interesting alternative to deal with information problems is to design or redesign institutions to improve market efficiency (Simon, 1996). The study on institutional economics (Eggertsson, 1990; Pejovich, 1998) deals with the need for institutions to align various interests. Institutions are regarded as the rules of the game and they can constitute a major determinant of risk. A good example is the lack of foreclosure laws in Thailand—a basic assumption of real estate lending is that if borrowers fail to repay, the lender can foreclose on the property. In Thailand, there were no institutions to do that. The flip side is that principal/agent conflicts can be remedied by structuring appropriate institutions. The interaction between institutional and information economics remains an interesting avenue for future research.

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