CHAPTER 13

The Microstructure of Housing Markets: Search, Bargaining, and Brokerage

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Abstract

This chapter surveys the literature on the microstructure of housing markets. It considers one-sided search, random matching, and directed search models. It also examines the bargaining that takes place once a match has occurred, with the bargaining taking various forms, including two-party negotiations of different types and multiparty housing auctions. The chapter reviews research on real estate brokers as intermediaries as well, focusing on the role of brokers in the matching and bargaining process, the nature of competition and entry in the brokerage industry, and the incentive issues that are present. The chapter also considers the inefficiencies that pervade the brokerage industry and the related policy debates. These are important issues both because of the inherent importance of housing and brokerage and because of the importance of housing to macroeconomic dynamics.

Keywords

Real estate, Housing, Search and matching, Intermediation, Bargaining, Incentives, Cycles

JEL Classification Codes

D82, D83, E32, L85, R21, R31

13.1. INTRODUCTION

There is a compelling case for learning more about housing markets. Housing is typically the largest element of a household's portfolio, so it is central to household finance. Coupled with the illiquidity of housing, this creates a strong empirical relationship between housing markets and labor markets. Housing is also a large part of aggregate capital. Coupled with housing's riskiness, this makes housing an important driver of the business cycle. Housing has played an especially large and unhappy role in the recent global recession. It is clear that households, investors, economic policymakers, and economists themselves all had incomplete understandings of how profoundly housing could affect balance sheets and economic activity more generally.

This chapter will examine one key aspect of housing markets by surveying the growing literature on how housing markets clear. The chapter covers the entire process of buying and selling properties. It discusses models of search, matching, and bargaining.[1] It also discusses models of real estate brokerage. The chapter reviews both theoretical work and empirical work. Not surprisingly, information issues are central.[2]

The analysis of housing markets must begin with the recognition that housing is a unique good. This means that the analysis of other markets cannot simply be brought to bear on the housing market without modification. This is not a new observation. Various previous surveys of housing have been organized around lists of key housing market features (e.g., Quigley, 1979; Arnott, 1987). We are interested here in the features of housing as an economic good, the key agents involved in housing markets, and the institutions that govern how housing is transacted.

Three aspects of housing are most important for our purposes. First, houses are heterogeneous. This is true with regard to both the many characteristics of housing units (i.e., square feet of structure and of lot, number of rooms, and age) and the neighborhood amenities and local public goods that are jointly consumed with housing (e.g., access

[1] Most of the literature deals with transacting a fixed stock of houses, so development and redevelopment will not be central themes of the chapter. Even so, some papers consider construction, which will interact with search in a way that has an important impact on housing dynamics.

[2] There is also a compelling case for learning about commercial real estate. Unfortunately, despite commercial markets involving similar frictions to residential markets, there has been very little research on search, matching, and intermediation in this setting. There is a clear need for more research in this area.

to work and school quality). This heterogeneity means that housing markets can be thin. Second, housing transactions take place under uncertainty. Buyers who are considering moving do not know which houses will suit their tastes until they search. Sellers who are considering moving do not know which buyers might be good matches for the houses that they hope to sell. As a result, buyers and sellers must search for each other. When they meet, neither buyers nor sellers are able to anticipate with certainty the price that the other party in the transaction is willing to pay or accept. Third, there are important market frictions. Search is a costly activity. In addition, the exchange of housing has important transaction costs, including brokerage fees, transaction taxes, and moving costs. In this situation, the housing market clears through price and time (unlike standard competitive models). This liquidity issue will have very important implications for the analysis of housing, as will be seen below.

The housing market is also unique in its institutions and in the economics agents involved in it. One very important aspect of housing is that it is a market dominated by amateurs. Roughly two-thirds of North Americans are homeowners, and these houses are a very important element in a typical household portfolio (see Tracy and Schneider, 2001 for US evidence). A significant share of these houses is transacted with the assistance of real estate agents (National Association of Realtors, 2005).[3] The listing agent is employed by the seller, typically earning a share of the sales prices as a commission. Although the cooperating agent works with the buyer, in a legal sense, the cooperating agent is usually a subagent of the listing agent. It is immediately apparent that there are potential incentive issues here in the use of these intermediaries to facilitate housing transactions. In North America, real estate agents make use of the multiple listing service (MLS) in helping their clients buy and sell houses. The MLS is typically controlled by real estate agent associations (boards) for the use of member agents only. There is controversy about how well this arrangement serves house buyers and sellers. It has been argued that this creates market power, resulting in higher costs of intermediation. On the other hand, it has also been argued that this resource has resulted in sellers and buyers having better information, which might lead to better market outcomes.

This chapter surveys the empirical and theoretical literatures on the microstructure of housing markets. It will consider models that respect the unique features of housing, will assess their ability to explain important facts, and will help researchers avoid certain logical fallacies that follow from analysis that lacks solid microfoundations. Figure 13.1 presents a

[3] In this chapter, we will follow the common practice of using the terms "broker" and "agent" interchangeably. In fact, there is a formal legal distinction between brokers and agents. The licensing requirements to be a broker are more strict, typically requiring both additional experience as an agent and additional education.

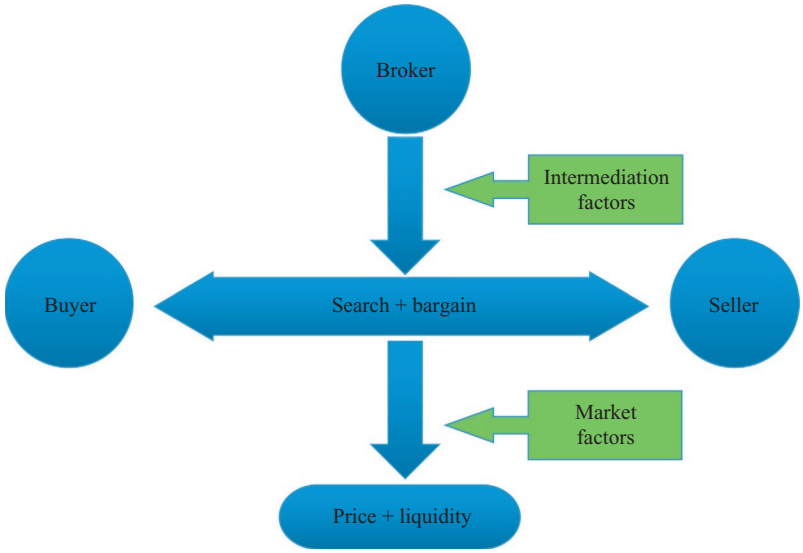

Figure 13.1 Housing market microstructure. *Note: The figure illustrates the key participants in housing transactions (buyers, sellers, and brokers) and the key outcomes (price and liquidity). These interact depending on market factors (listed in Figure 13.2) and intermediation factors (listed in Figure 13.3).*

graphical approach that can be used to understand how the literature has evolved. As with any market, there are buyers and sellers. There may also be a third type of agent, the real estate brokers who intermediate transactions. These agents interact in a number of ways, with the matching between buyers and sellers and the bargaining that ensues being central. The key outcomes are the price at which the house sells and the liquidity of the transaction (if one takes place), typically measured by time-on-market. The research reviewed here considers how these outcomes are affected by a range of market and strategic forces that impact search, matching, and bargaining and also forces that impact intermediation. The former (denoted "Market factors" in the figure) include seller characteristics, house characteristics, market conditions, and a range of strategic choices made by buyers and sellers. Figure 13.2 gives a selective summary of the literature related these factors. Sections 13.2–13.6 discuss this research. The latter (denoted "Intermediation factors" in the figure) include various factors that affect broker performance, such as the ownership of a property, the use of a broker, brokerage representation, the exclusivity and duration of contracts, the nature of compensation structure, and possible incentive alignment issues. Figure 13.3 selectively summarizes research on these factors. Sections 13.7–13.9 discuss this research and also related research on entry, competition, and efficiency in the brokerage industry.

The theoretical literature has moved from simple partial equilibrium models to increasingly rich general equilibrium models with strong microfoundations. For

Categories	Market factors	Selected literature
Seller characteristics	Seller motivation	Albrecht et al. (2007) and Glower et al. (1988)
	Seller equity	Genesove and Mayer (2001)
House characteristics	Idiosyncrasy of the property	Haurin (1988)
Market conditions	Demand shocks	Genesove and Han (2012a)
	Amplification through entry	Wheaton (1990), Novy-Marx (2009), Annenberg and Bayer (2013), Ngai and Sheedy (2014)
	Seasonality	Ngai and Tenreyro (2009), and Salant (1991)
	Market thinness	Genesove and Han (2012b)
	Cyclical variation	Krainer (2001), Diaz and Jerez (2013), and Head et al. (2014)
Strategy	Asking price	Albrecht et al. (2013) and Han and Strange (2014)
	Bargaining	Merlo and Ortalo-Magné (2004), Merlo-Ortalo-Magné - Rust (2013), and Harding et al. (2003)
	Auctions	Ashenfelter and Genesove (1992), Han and Strange (2013)
	Pre-search	Williams (2014) and Piazzesi et al. (2013)
	Advertising	Carrillo (2012)

Figure 13.2 Market factors. *Note: This figure illustrates a range of market factors that the literature has considered. The papers listed are examples only; see the text for a more complete review.*

Intermediation factors	Selected literature
Broker-owned vs. client-owned properties	Rutherford et al. (2005) and Levitt and Syverson (2008a)
Broker-listed vs. FSBO properties	Hendel et al. (2009)
Traditional vs. discounted brokers	Bernheim and Meer (2013) and Levitt and Syverson (2008b)
Exclusive vs. open agency contracts	Rutherford et al. (2001, 2004) and Bar-Isaac and Gavazza (2014)
Broker representation	Miceli (1991), Yavaş and Colwell (1999), Gardiner et al. (2007), and Han and Hong (2014)
Contract duration	Miceli (1989) and Anglin and Arnott (1991)
Full-commission vs. split-commission brokers	Munneke and Yavaş (2001) and Johnson et al. (2008)
Incentive mitigation: competition	Williams (1998) and Fisher and Yavaş (2010)
Incentive mitigation: broker reputation	Shi and Tapia (2014)

Figure 13.3 Intermediation factors. *Note: This figure illustrates a range of intermediation factors that the literature has considered. The papers listed are examples only; see the text for a more complete review.*

example, in one-sided search models, the process that generates the arrival of counterparties is typically modeled in an *ad hoc* way. In both random matching and directed search models, in contrast, the arrival is an equilibrium outcome, consistent with maximization and learning by the involved parties. Future progress in this area will continue to require attention to microfoundations and equilibrium.

Clear advances to knowledge of both brokerage and matching have come from taking these microfounded theories to data. There have been significant contributions that have adopted modern approaches to identification in reduced-form settings. There have also been significant contributions arising from taking explicit structural approaches and from calibrations. But these approaches have not been the only source of empirical progress in this area. The field has also benefitted from newly available data sources.[4] For instance, researchers have used new microdata on the offers and counteroffers for a house, on search activity itself, and on nontraditional marketing strategies such as discount brokers. Further progress will therefore rely on both advances in econometric methods and improvements in data.

The remainder of the chapter is organized as follows. Section 13.2 lays out simple one-sided buyer and seller search models. Despite their simplicity, these models explicate some of the key forces at work. The chapter then moves on to consider richer equilibrium models of search and bargaining. Section 13.3 focuses on random matching models, while Section 13.4 covers models where agents strategically focus their search on segments of the market. Section 13.5 considers directed search. In random matching and directed search, bargaining is usually between one buyer and one seller who have met each other. Section 13.6 discusses auctions as a way to transact houses, both formal auctions taking traditional forms and bidding wars that are auctions in fact if not in name. The last three sections in the body of the chapter consider real estate agents as intermediaries, including coverage of fundamentals (Section 13.7), the nature of competition (Section 13.8), and incentives (Section 13.9). Section 13.10 concludes.

13.2. ONE-SIDED SEARCH

We will begin with one-sided models of search. Despite their simplicity, theoretical models of this sort can be quite insightful in explaining how the market factors from Figures 13.1 and 13.2 impact the key transaction outcomes of price and time-on-market. They can also provide a foundation strong enough for careful structural estimation. The most common sort of one-sided model deals with the house seller's problem. There are, however, other sorts of one-sided model, including models of buyer search and models of real estate agent search for buyers and sellers.

[4] These new sources include CoreLogic, DataQuick, and Internet-based data from sources such as Trulia, Google, Yelp, and Craigslist, to name just a few.

The earliest model of this kind of which we are aware is presented as a part of Simon's (1955) classic analysis of bounded rationality. The body of this paper deals with satisficing as a consequence of, among other things, decision making under uncertainty. There is a brief discussion of the home seller's problem as an instance of this sort of decision making. In the Appendix, there is a formal model of the home seller's problem where offers arise sequentially from a known distribution. The seller must accept or reject these offers, with no recall of previously rejected offers allowed. Simon establishes conditions under which there exists an optimal "acceptance price." Although it is clear that buyers do not simply arrive randomly bearing take-it-or-leave-it offers that expire immediately and irrevocably on their rejection, Simon's analysis of this stopping problem captures some of the most important features of housing transactions: sellers do not know the value of their houses to potential buyers, and they do not know which buyers will visit and when such a visit might take place.

Characterizing this sort of problem as a kind of search, where the acquisition of information is modeled as an economic process, begins with Stigler (1961, 1962). He considers search in goods and labor markets. He does not discuss housing. More modern treatments of search in housing—all one-sided models—are offered in the seminal models of Courant (1978), Stull (1978), Yinger (1981), Haurin (1988), and Salant (1991).

13.2.1 One-sided buyer search: Theory

The first buyer search model in the urban literature is Courant (1978). This model illustrates both the key building blocks of search models and the key motivation for considering search frictions: that such frictions can explain observed outcomes in ways that standard competitive models cannot.

Consider the following simplified version of Courant's model. Buyers search among houses with a cost of c per search. They choose between neighborhoods $j=1, 2$.[5] The value to the buyer of a particular house, x_i, is learned only after visiting. The *ex ante* distribution of x is $f(x)$, which is assumed to be equal across neighborhoods. There are two types of buyers: blacks and whites. Sellers are identical except that some will not sell to blacks, with this behavior being unobservable prior to a visit. Let α_j denote the fraction of discriminating sellers in neighborhood j. This is assumed to be known by the searching buyer. Courant abstracts from pricing by assuming that prices arise from a hedonic equilibrium that is independent of race. We will simply assume that houses are identical and prices are fixed.

Search in this model has the standard rule that a buyer should search until obtaining a house above a quality threshold x^*. In the presence of discrimination, search will be limited by neighborhood. For a sufficiently high value of α_j, blacks will not search in neighborhood j. Search frictions, thus, result in segregation. It is worth noting that the

[5] Courant actually considered an arbitrary number of neighborhoods, J.

segregation only requires that some agents discriminate, not that they all do. In a competitive model, in contrast, discriminatory preferences would be competed away. Courant shows how transaction costs make it unlikely that this discrimination can be arbitraged away. The welfare economics here are thus different than under perfect competition with complete information (although his treatment of pricing here makes it hard to compare). It is worth noting, however, that this model forces statistical discrimination to manifest itself in neighborhood choices rather than in pricing by the assumption of exogenous pricing.

In addition to generating segregation, Courant shows how search and discrimination can interact to produce neighborhood tipping, when a neighborhood's composition changes catastrophically. The most natural way to see this is to suppose that blacks never refuse to sell to other blacks, but a fraction of whites do. Suppose also that some blacks are willing to search even in white neighborhoods. This could be explained by heterogeneity in income within the black population coupled with heterogeneity in neighborhoods. In this case, as a neighborhood becomes more black, the likelihood falls of a buyer wasting time searching the listing of a discriminating seller. This leads to a critical share of black homeowners beyond which all black households would be willing to search in predominately white neighborhoods, an instance of tipping.

13.2.2 One-sided buyer search: Empirics

There has been relatively little empirical research on buyer search that relates to the one-sided theory discussed above. This seems to be a consequence of data availability. While it is standard for MLS data to report time-on-market for a seller (see below), there is no parallel for a buyer's time-on-market in any standard data set. As a result, empirical research about the buyer-side search activities would require significant effort in data collection and compiling.

Anglin (1997), Elder et al. (1999), and Genesove and Han (2012a) are examples of this sort of research. Based on a survey of buyers, Anglin found, among other things, that information is central to buyer search, whether measured by buyer time-on-market or the number of houses visited. Using cross-sectional data from the National Association of Realtors' (NAR) buyers and sellers surveys, Elder et al. considered the number of houses seen per week. They showed that less-informed but arguably more motivated out-of-town buyers search more intensively. More recently, Genesove and Han aggregated microdata from the NAR buyers and sellers surveys to the metropolitan statistical area (MSA) level, for available years from 1987 to 2008, to form a panel data set of home search activities. They considered buyer time-on-market and the number of home visits, in a random matching two-sided model that also considers sellers. Since buyers are arguably more active than sellers are, empirical research on buyer search is essential for reaching a better understanding of housing markets.

13.2.3 One-sided seller search: Theory

There is a much larger body of work that models the home seller's problem as a process of one-sided seller search. Stull (1978) and Salant (1991) are two particularly influential papers. Stull (1978) considered this sort of trade-off for a rental landlord. Salant (1991) considered the sales process for a homeowner.

Housing search models in this tradition typically have a number of common features, and we will work with a hybrid. There is one house seller facing a sequence of randomly arriving buyers. The seller sets an asking price. This is interpreted as a commitment in the sense that a sale occurs when a randomly arriving buyer is willing to accept. In this setup, there is essentially a take-it-or-leave-it offer of the asking price that the randomly arriving buyer considers. Other bargaining setups are obviously possible, and they will be considered below.

These models all generate some version of the fundamental asking price trade-off: a lower asking price results not only in a lower sales price (by construction) but also in an earlier expected sale. In any search model, markets clear on both price and time. In the case of the housing market, the time dimension captures the liquidity of housing assets and the frictional rate of vacancy of housing markets.

Salant's (1991) model adds some additional dynamic issues to the analysis. He places housing search in a nonstationary setting with a fixed (spring and summer) house sale season. This leads to asking price declining over the season despite his maintaining the usual assumption that there is a constant probability of a buyer arrival with buyers drawing idiosyncratic match values upon their visits.[6] Overall, there has been relatively little research on housing search in a nonstationary setting. Merlo et al. (2013), discussed below, is a recent exception.

13.2.4 The empirics of one-sided search

13.2.4.1 Duration

There is an extensive literature on the price–liquidity relationship that the theory of seller search motivates. Cubbin (1974) and Miller (1978) are early papers that show an empirical relationship between price and seller time-on-market.

Haurin (1988) is seminal in this line of research. He considers the heterogeneity of housing in a one-sided search setting. He is specifically interested in the atypicality of a particular house. As Haurin notes, some houses have unusual features such as swimming pools in cold climates or unusual ratios of bedrooms to bathrooms. In Haurin's analysis, this affects the variance of the value of a house but not the mean. It is straightforward to see that this leads to a stricter stopping rule (higher price offer to persuade a seller to

[6] Salant also considered the decision of when to hire an agent, an issue that will be considered later in the chapter.

transact) and a longer marketing time. Haurin makes use of a small data set (219 transactions) from Columbus, Ohio, to assess the empirical validity of these predictions. It has been usual in this literature to work with small data sets from one market. This is because larger cross-sectional or panel data have previously lacked the hedonic characteristics that are needed. This has changed.

Empirically, atypicality is measured as follows. Let β_i denote the hedonic price of the ith attribute in a sample. Let $\overline{x}_i$ denote the average of the ith attribute. The atypicality of a given home is then defined as the sum of the absolute values of the differences in its attributes from the mean weighted by the hedonic prices of the attributes, $\sum \beta_i |\overline{x}_i - x_i|$. This measure of atypicality has become the standard approach in housing research.[7] Haurin's principal conclusion is that less typical houses do take longer to market, as predicted.

13.2.4.2 Seller motivation

A long list of other papers has considered related liquidity (time-on-market) issues with a one-sided seller search model as the theoretical foundation. Zuehlke (1987) showed that vacant houses exhibit positive duration dependence, with the hazard of sale rising with time-on-market. This result is interpreted as arising from the keen motivation of this group of sellers. Glower et al. (1998) considered seller motivation directly. They employ data on planned moves, and they find that sellers who plan moves sell sooner than those who do not. They also showed that the time to the planned move is associated with seller time-on-market, with sellers planning to move sooner choosing to sell sooner. This result follows naturally from a one-sided model. Springer (1996) also considered motivation, again reaching the conclusion that motivated sellers sell more quickly.

13.2.4.3 Seller equity

Genesove and Mayer (1997) did not write down an explicit search model, but their results can be understood as fitting in this tradition. They considered the impact of homeowner equity on the home sale process. It is straightforward to extend the above seller model to include sellers who vary in their reservation prices. One source of this heterogeneity is that some sellers may have little or even negative equity in their houses. In this case, they will only be willing to sell if they encounter a high-willingness-to-pay buyer. This will lead the sales price of a house to be higher and the time-on-market to be longer when there are equity constraints. They tested these predictions using a unique sample of matched buyers and sellers. The positive relationship between the seller's loan-to-value ratio and duration is shown to be quite robust.

[7] This measure is frequently used to measure heterogeneity, including the recent papers by Haurin et al. (2010), Bar-Isaac and Gavazza (2014), and Han and Strange (2014).

13.2.4.4 Asking price

In the basic seller search model sketched above, the bargaining process is a simple one. Housing is treated as a posted-price market, where buyers arrive and are either unwilling to pay the seller's asking price (in which case, search goes on) or willing (in which case, there is a transaction and the search ends). While this approach is conveniently tractable, it does not capture the bargaining stage of housing transactions. We will deal with this issue extensively below. For now, we will deal only with the line of empirical research that treats asking price as a price posting and looks at the relationship between asking price and the search process.

A long line of research of this sort has dealt with the relationship between the asking price and the outcome variables of sales price and time-on-market. See, for instance, Miller and Sklarz (1987). The idea is that an overpriced house will be less attractive to visitors and so will be on the market for a longer period. It will, however, sell for a greater price. This approach is clearly a reasonable way to think about search in a goods market. If a grocer advertises a high price for apples, fewer customers will visit the store to inspect the apples and decide if they are worth buying. However, a house is different from an apple in many ways, one of them being that houses do not always sell at their posted prices (although a notable fraction do, as observed in Han and Strange, 2014). This means that the theoretical link between overpricing and outcomes requires some further thought. See also Pryce (2011) for the observation that markets will vary in what the asking price means, implying that measures of overpricing should capture these cross market differences. Having said this, the reduced-form empirical literature clearly establishes that there exists a robust relationship between various measures of overpricing and outcomes. Yavaş and Yang (1995) showed that a higher asking price, controlling for characteristics, leads to a longer time to sale. Anglin et al. (2003) showed that the difference between asking price and a hedonic prediction of sales price is related to longer time to sale. Later in the chapter, we will discuss theoretical models of the interaction between search and bargaining that can help to understand these important results.

13.2.5 Conclusion

Taken individually, each of the one-sided approaches discussed above has plausible microfoundations. Buyers clearly must incur costs to evaluate houses for purchase (or rent, although renting is typically not considered). Sellers incur costs too: in the extreme, staging; in a less extreme case, preparing a house for viewing by cleaning, tidying, buying flowers, and absenting oneself. And finding an agent has its own set of uncertainties and search costs, which could be understood using the same sorts of model. Search models seem a very natural way to capture these situations. Versions of the key results from these one-sided models will reappear throughout the chapter.

However, one-sided models by construction take the process that generates the arrival of counterparties as exogenous. In Merlo et al. (2013), the setting is in the United Kingdom, where the process of search does indeed seem to be well described as one of one-sided seller search. Their structural analysis, discussed in greater detail below, solves for optimal search behavior for sellers based on an empirically derived process of offer arrival. This insightful approach requires data on offers, which is difficult to obtain. In other one-sided models, the counterparty arrival process is arbitrary, which is not very satisfying. Section 13.3 will begin to consider general equilibrium approaches where both buyers and sellers optimize their search.

13.3. RANDOM MATCHING

This section considers random matching models of housing search. It also considers the bargaining that takes place after buyers and sellers meet, since bargaining is an inseparable part of the search and matching process. As in Figures 13.1 and 13.2, it will consider a range of market factors that influence housing transactions, with additional factors considered later in the chapter.

The models discussed in this section are adapted from labor economics, where search models have proven to be remarkably useful. The work of Diamond, Mortensen, and Pissarides is seminal. See, for instance, Diamond (1982), Mortensen (1982), Mortensen and Pissarides (1994), and Pissarides (1985), among others. This vast literature has been surveyed many times, including Pissarides (2002), Rogerson et al. (2005), Shi (2008), and more recently Rogerson and Shimer (2011), and we will not attempt such a survey here. We will focus instead on how models in this tradition have been applied to housing economics.

The labor literature has shown that search models can help to understand a number of fundamental issues about labor economics. As noted in Rogerson et al. (2005), these include the duration of unemployment spells, the simultaneous existence of unemployment and job vacancies, the determination of unemployment and turnover, and the interaction of wage and turnover in equilibrium. There are parallels for all of these issues in housing. These include time-on-market, housing vacancies and turnover, and the dynamics of price, construction, and liquidity. As will be seen below, random matching models of housing markets illuminate all of these issues.

Random matching models also help to understand some of the key stylized facts of housing dynamics and thus contribute to the understanding of the great boom and bust that took place in the 2000s. Different authors have focused on different facts. As a taxonomy, we see three broad types of fact that have been considered. First, there is a tendency toward cycles in housing markets in the sense that there is short-run positive serial correlation of price but long-run mean reversion (see Case and Shiller, 1988). Construction also shows persistence (Glaeser and Nathanson, 2014). Second, shocks to

fundamentals result in amplified effects on housing prices and quantities, an instance of "excess volatility" (Shiller, 1982; Glaeser et al., 2014). Third, there are regularities in how price, sales, and various dimensions of liquidity such as time-on-market move together across time. Price and sales exhibit positive correlation, while price and seller time-on-market show negative correlation (Stein, 1995; Krainer, 2001; Glaeser et al., 2014). See Glaeser and Nathanson (2014) for an extensive discussion of how these facts relate to the phenomenon of housing bubbles.

The parallels between housing search and other sorts of search are sometimes not exact, however. There are issues unique to housing that must be addressed. One of these is that buyers of houses are also sellers. This means that the search frictions in housing markets are different and more serious than in labor markets. This has been shown to lead to increases in volatility. It also means that the market clears on price and both buyer liquidity and seller liquidity. This has implications for empirical work. Another key difference is that there is bargaining over price. While there is also bargaining over wage, this is not a feature of most labor search models. That the asking price is not exactly a posted price will matter, both theoretically and empirically. Furthermore, the role of intermediaries in housing search is absolutely central, while labor market intermediation is secondary. We will deal with all of these in this section and later in the chapter.

13.3.1 Random matching: Basics

The following is a simple example containing the key elements of a random match model of housing. Although it is derived from Genesove and Han (2012a), there are numerous other instances of this kind of model in the housing literature.[8] Let n_b and n_s give the numbers of buyers and sellers in a market. Both are assumed to be risk neutral. Let $\theta = n_b/n_s$ denote market tightness. Let $m(n_b, n_s)$ denote the rate of meetings or contacts between counterparties. We suppose that $m(-)$ exhibits constant returns, as is conventional. Not all contracts will lead to matches, since some matches are not productive enough. Whether a contact leads to a successful transaction depends on the total surplus that the contact generates.[9]

In this setup, the probability of a given seller being contacted by a random buyer can be expressed as

$$q_s(\theta) = m(n_b, n_s)/n_s = m(\theta, 1). \tag{13.1}$$

Similarly, the probability of a given buyer being contacted by a random seller can be expressed as

[8] See, for instance, Wheaton (1990), Krainer (2001), Albrecht et al. (2007), and Novy-Marx (2009).

[9] See Pissarides (2000) for a discussion of the concepts of meeting and matching functions. The former refers to contacts between agents, while the latter refers to successful contacts that result in ongoing matches.

$$q_b(\theta) = m(n_b, n_s)/n_b = m(1, 1/\theta). \tag{13.2}$$

We then have $q_s(\theta) = \theta q_b(\theta)$. Assuming that $m(-)$ is increasing in both arguments gives $q_s'(\theta) > 0$ and $q_b'(\theta) < 0$. When a contact is made, the idiosyncratic match utility of a particular house for a particular buyer, x_{ij}, is realized. *Ex ante*, it is a draw from $g(x)$. This distribution is known to both buyers and sellers. Define $y = V_b + V_s$ as the sum of the reservation values of the buyer and the seller. We will treat V_b as exogenous, which means that there are many markets from which a buyer might choose. Then, the surplus from a match equals $x - y$. The probability of a transaction conditional on a meeting equals $G(y) = \text{prob}(x - y \geq 0)$. The expected surplus conditional on a transaction equals $E(x|x - y \geq 0) - y$. When a meeting occurs, the seller and buyer engage in Nash bargaining over the potential surplus from the transaction. Let β represent seller bargaining power and $(1 - \beta)$ represent buyer bargaining power. In this case, given a transaction, the expected price will be

$$p = V_s + \beta^*[E(x|x - y \geq 0) - y]. \tag{13.3}$$

Finally, let the cost of a search be c_b and c_s for buyers and sellers, respectively, and let r be the interest rate.

The endogenous variables are y and θ. In equilibrium, the asset equations governing search are

$$rV_s = q_s(\theta)G(y)^*\beta^*[E(x|x - y \geq 0) - y] - c_s, \tag{13.4}$$

$$rV_b = q_b(\theta)G(y)^*(1 - \beta)^*[E(x|x - y \geq 0) - y] - c_b. \tag{13.5}$$

Equation (13.4) requires that the opportunity cost of a seller continuing to search for another period must equal the net benefit of seller search. The latter equals the probability of the seller matching multiplied by the probability of a meeting resulting in a transaction multiplied by the price that the seller receives, minus the search cost. Equation (13.5) is similarly a requirement that the opportunity cost of buyer search equals the expected net benefit accruing to buyers from continuing to search. It is worth observing that without the convenient assumption of fixed buyer utility, there would be a third endogenous variable, buyer utility V_b. This would be determined by an entry condition for buyers. Some of the models discussed below take this approach.

This basic random matching model can generate some of the stylized facts discussed above. It gives amplification in the sense that the short-run adjustment to a shock can generate overshooting. In addition, this basic random matching model can generate a positive price–volume correlation. The model requires modification in order to generate the persistence mentioned at the beginning of the section. We will return to this later.

The model also makes predictions about how housing market liquidity—measured by buyer time-on-market, seller time-on-market, and the number of visits made by a

buyer—would respond to shocks. A positive demand shock that increases the expected surplus from a transaction increases the buyer to seller ratio (market tightness), which further increases the seller contact hazard $q_s(\theta)$ but decreases the buyer contact hazard $q_b(\theta)$. Such demand shock also increases the probability of a transaction conditional on a contact, making each home visit more productive. As a result, a positive demand shock would decrease both the seller time-on-market and the number of home visits that a buyer makes, but its net effect on buyer time-on-market is ambiguous.

Using National Association of Realtors' buyers and sellers surveys from 1987 to 2008, Genesove and Han (2012a) assess these predictions. They find that an increase in income or in population has substantive and negative effects on seller time-on-market and the number of visits made by a buyer. However, these effects are much smaller and less significant in the long run. These results are consistent with a random matching model where sellers react to demand with a lag and interest rate is effectively negligible. Their findings also imply that the elasticity of the hazard that any given seller will be contacted by a buyer with respect to the buyer–seller ratio is 0.84, assuming that a constant returns to scale matching function. Thus, a doubling of the buyer–seller ratio would increase the likelihood of any given seller being contacted by a buyer by 79%.[10] Such a large seller contact hazard elasticity is consistent with the seller listing institutions in North American real estate markets.

13.3.2 Intensity choice

The basic random matching model has been extended in numerous ways (recall Figures 13.1 and 13.2). We will consider several of these, beginning with the choice of search intensity.

Suppose that buyers and sellers choose their intensity of search and that this will impact the likelihood of a match taking place. The match probability for a given seller now depends on the market tightness, own effort, the effort of other sellers, and the effort of buyers. Own effort and the effort of buyers increase the probability of a match, while the effort of other sellers decreases the probability. The setup for buyers is parallel. In this situation, the comparative static results discussed above for market liquidity are preserved under certain restrictions on the modified matching function. Loosely, it suffices that the marginal cost of effort rises sufficiently quickly and that seller effort is sufficiently dissipative.[11]

[10] It is worth noting that Head et al. (2014) arrive at a quite similar estimate using very different data and methods. We discuss this paper below.

[11] Seller effort is dissipative in that increasing seller effort would only steal buyers away from other sellers without much effect on improving the overall matching rate. See Genesove and Han (2012a).

13.3.3 Entry

The basic random matching model above treats buyer utility as exogenous. Novy-Marx (2009) supposed instead that both buyer entry and seller entry depend on the payoffs of, respectively, buying and selling a house. He does this by supposing exogenous functions giving the number (literally, measure) of house buyers and sellers as functions of price. These functions capture outside alternatives. For instance, housing construction is almost certain to grow when the price rises. Furthermore, a buyer would presumably be more willing to move to another market if his/her house would sell for more. Of course, if the other market was positively correlated, this incentive would be weaker (see Han, 2010, for a discussion of correlations and the management of risks in housing transactions).

This setup then generates the important result that these natural entry processes lead to an amplification of shocks. In Novy-Marx's usage, there are "hot and cold markets." The amplification works as follows. Suppose that there is a shock to demand, perhaps from a change in mortgage standards allowing more households to qualify for mortgages. This increase in the rate of buyer entry leads to a shorter time-on-market. This, then, further increases the ratio of buyers to sellers, amplifying the effect of the initial increase in buyer entry. A similar amplification story would apply in cold markets. This result shows how the search structure of housing markets contributes to their often-observed cyclical nature.

In all of these models, buyers and sellers are different agents. In fact, as discussed above, one of the most important unique features of housing is that buyers are sellers. As long as the inflow of such "dual" agents had no effect on the net inflow of buyers less sellers, ignoring them would not be consequential to the steady-state analysis. However, it is possible that for such "dual" agents, their subsequent actions as buyers or sellers are strongly interrelated, which would affect the resulting house price and market liquidity. We will now turn to the seminal model of this sort.

13.3.4 Turnover and the joint buyer–seller problem

Wheaton (1990) presented a model of what might be called "in-home search." The model is parallel to models of labor search where workers consider possible alternate positions while they are on the job. The crucial innovation in this model is its recognition that homebuyers are frequently home sellers. It is, thus, a model of turnover. That buyers are sellers and that these roles are linked is an important difference between housing search and labor search.

Wheaton's model considers this link as financial. There are two types of houses and households. Households suffer a utility penalty if they are occupying a house that is not well matched to their type. Random shocks move households into a poorly matched state, requiring them to buy a new house. After they do this, they occupy two houses, one of them vacant, until they sell it. While this approach ignores some of the issues

involved in changing houses, it captures the crucial fact that a given agent operates as both a seller and a buyer. The other elements of the model are as in the above random matching framework: there is random contact between agents that depends on effort. One important simplification is that some of the analysis supposes that the matching probability depends only on effort and not on vacancy.

The model generates some of the key stylized facts of the housing market: the existence of structural vacancy in steady state and the possibility of amplification, where a small shock to fundamentals produces large movements in price. In this case, because buyers are also sellers, the price needs to rise substantially to equilibrate in response to a demand shock. This channel through which search can affect the amplitude of cycles depends critically on the fact that in housing, turnover means something different than in other search markets.

Turnover is also central to a recent paper by Anenberg and Bayer (2013). They considered a more specific sort of turnover than Wheaton, situations where households buy and sell one house within a market. They showed that this internal turnover is highly volatile and, in fact, the primary element of housing volatility. They then developed a search model to incorporate this. For internal moves, the cost of holding two houses varies endogenously over the cycle. They estimate the model using Los Angeles data on moves, prices, and marketing times. The empirical analysis shows that this turnover issue amplifies the real estate cycle.

Head et al. (2014) worked with a calibrated search model that examines the dynamics of house prices, sales, and construction and the entry of buyers in response to city-specific income shocks. This allows them to assess the ability of such a model to quantitatively match the key stylized facts for the US housing markets. In their model, the entry of new buyers and the construction of new houses are endogenously determined. Every homebuyer eventually becomes a seller through either a failed match with the city she lives in or a failed match with the house she currently owns. This results in the movement of the owner to temporary renting, searching for a new house, and the owned house being put on the market. With these new features, Head et al. showed that a random matching model can generate short-term persistence in price growth and construction even in the absence of persistent income growth. Quantitatively, their calibrated model accounts for over 80% of house price volatility driven by city-level income shocks and nearly half of observed serial correlation in-house price growth.

Ngai and Sheedy (2014) employed a model that endogenizes the moving decision. In the other models considered here, such as Head et al. (2014), matches between homeowner and house become unproductive according to a random process. By assumption, when a match becomes unproductive, the household must move. Ngai and Sheedy endogenized moving by supposing that a household chooses to move according the stochastic quality of the match, which is the outcome of series of smaller shocks rather than a discrete and total loss of match quality. The critical match quality at which a household

moves is solved for as an equilibrium level. This leads to amplification, since a shock leading some households to move will encourage further moves due to thick market effects. It also leads to what they label as "cleansing," since the remaining matches are those of higher quality. This means that there is overshooting as the economy adjusts to a new steady state.

This line of literature is quite important. Housing markets are notoriously cyclical. The papers discussed above help to understand housing cycles in several related ways. They establish that small changes in fundamentals can lead to large changes in outcomes, which helps to explain the volatility of real estate. They also help to explain some of the key cyclical properties of housing markets. These include the persistence of house price changes in the short run and the comovements across the cycle of price, volume, liquidity, and vacancy. Given the profound impacts of the recent boom and bust cycle, there is clearly a strong case for further research in this area.

13.3.5 Opportunistic matching

Albrecht et al. (2007) presented a model that captures the increasing desperation that seems to characterize housing search. Their model starts with the standard elements of matching models. They captured desperation in a creative and elegant fashion by assuming that agents begin as relaxed, with high flow values from being in an unmatched state and continuing to search, and then become desperate according to a Poisson process. They showed that there are various forms that the equilibrium can take, including indiscriminate matching (where all matches are consummated), opportunistic matching, where desperate agents match with everyone but relaxed ones wait in the hope of encountering a desperate counterparty. There is also a type of equilibrium where only the desperate match.

The model fits with empirical observation in various ways, including the relationship between time-on-market and price. The two-state structure of the model (relaxed or desperate) allows for very sharp characterizations of equilibrium strategies. Of course, this kind of exogenous change in payoffs is not the only transition that might take place for a buyer and seller during a housing search. There could be changes in market circumstances or learning. And the relaxed/desperate states could be interpreted as capturing buyer and seller rationality or irrationality.

13.3.6 Seasonality and market thickness

The above analysis has considered constant returns matching functions. It is possible that matching functions exhibit increasing returns, in which case there would be thick market effects (see Petrongolo and Pissarides, 2001). There are several potential sources of variations in thickness across markets. One is the classic urban economic phenomenon of agglomeration: larger cities have thicker markets. Another kind of variation occurs across

the business cycle, with volume varying cyclically. Yet another is found in the well-known seasonality of real estate markets. This was captured in Salant's (1991) one-sided, nonstationary model of the home seller problem.

More recently, Ngai and Tenreyro (2014) carried out a search and matching analysis of this issue. The paper is motivated by the preference of buyers and sellers to exchange houses during the "hot" second and third quarters of the year. Using UK data, the seasonalities are documented and shown to be parallel to similar patterns documented in other markets. This is used to motivate a model where households have exogenous changes in move preference by season due to the school calendar and other factors. In this search and matching model, these exogenous preferences generate thick market effects, thus amplifying the effects of shocks. The model is calibrated, and the calibrated model accounts for seasonal fluctuations in both the United Kingdom and the United States.[12]

13.3.7 Liquidity

A common feature of every model reviewed so far (and many of them that will follow) is that housing markets clear on both liquidity and price. This has clear implications for the construction and interpretation of house price indices. In particular, the market frictions captured by search predict that there is a relationship between price and time-on-market for both buyers and sellers.

Krainer (2001) is a classic model in this spirit. He presents a random matching model that predicts cyclical liquidity of owner-occupied houses.[13] In the basic version of the model, sellers have a high opportunity cost of failing to sell during a given period, and this encourages more rapid sales. A buyer's opportunity cost of mismatch—continuing to search—is assumed to equal the loss of housing consumption. Since this is greater by assumption in a boom, buyers also transact more rapidly in a boom. Interestingly, Krainer showed that with a frictionless rental market, these liquidity effects are not present, since it is possible to benefit from the boom without a purchase. Since the simultaneous existence of rental and purchase markets is an important feature of housing markets, this is a valuable result.

The relationship between liquidity and price raises immediate and fundamental questions. Standard assessment practice is that a house's assessed value should equal the amount that the house would sell for in an arms' length transaction taking a reasonable amount of time. But what is reasonable? And if marketing time depends on the state of the market, then what can one say about the performance of price indices? Furthermore, it has long been recognized that house price can provide information on the value of

[12] Harding et al. (2003) considered estimate bargaining power using American Housing Survey data. Among the interesting results of this paper is that bargaining power is seasonal for families with children, with the pattern consistent with intuition.

[13] See also Krainer and LeRoy (2002).

unmarketed amenities since the amenities are jointly purchased with the house. What is the implication of search and illiquidity for the interpretation of this information?

Several papers have considered this issue. Kim (1992) showed how search truncates the set of possible transactions and introduced biases into estimates of hedonic coefficients. He proposed a maximum likelihood approach accounting for the truncation to address the bias. He implemented the model on American Housing Survey rental data from Sacramento. One result that is particularly relevant to search is that new residents, who presumably face higher search costs, have higher reservation prices.

Fisher et al. (2003) analyzed commercial real estate indices in a similar context. The core of the paper is a search model of commercial real estate. Buyers and sellers both have reservation prices, and transactions require a match where the buyer's reservation price exceeds the seller's. It is well known that volumes (the inverse of liquidity) vary procyclically. This can be captured in the Fisher et al. model by supposing that shocks have different impacts on buyer and seller reservation prices. In this case, Fisher et al. showed that indices need to be adjusted for liquidity in order to present an accurate picture of the state of the market.[14]

They implement an approach to controlling for liquidity that follows Heckman's (1979) sample selection methods. Identification requires variables that impact seller reservation prices but not buyer reservation prices and vice versa. The liquidity-controlled indices show higher appreciation in booms and greater depreciation in busts. Liquidity correction, thus, shows greater volatility than without correction. They find rather large differences, with the liquidity-corrected index having compound appreciation rate of 0.52% over their sample period, while the uncorrected rate is 0.76%. Of course, commercial real estate is a private market where properties are quite heterogeneous, so liquidity is likely to be especially important.

Goetzmann and Peng (2006) presented a related analysis of a residential market that also shows the necessity of a liquidity adjustment. They presented a procedure that is distinct from Heckman's approach, relying instead on the specifics of the error structure in the models of reservation price and sales price. They calculate liquidity-corrected indices using a repeat sales approach for the Los Angeles MSA. As with other approaches, they again found greater volatility in the corrected series, with higher increases in booms and larger decreases in busts. The correction, while statistically significant, is considerably smaller than in the Fisher et al. (2003) analysis of commercial real estate.

The analysis in these papers shows that considering liquidity is required in order to understand how the housing market evolves. Two recent related papers have made

[14] This paper is rare in focusing on search in a commercial context. Commercial markets are clearly thin, arguably more so than residential markets. Data, however, are scarce, and this seems to have led to an absence of research in this area.

important progress in this regard. Carrillo (2013) developed an index of the "heat" of a housing market that comes from an analysis incorporating search and liquidity. Carrillo et al. (2014) showed that this index can predict future housing movements, a result related to the previously noted results on price momentum and the comovements in price and liquidity across the business cycles.

The analysis also suggests the welfare calculations based on hedonic prices are telling only part of the story, since liquidity is ignored. To measure the value of an attribute requires a correction for illiquidity that is comparable to the corrections discussed above for house price indices. Zahirovic-Herbert and Turnbull (2008) carried out such an exercise for school pricing. There is clearly room for further research of this sort.

13.3.8 Behavioral issues

The literature reviewed thus far has taken the standard economic approach of supposing that all agents are rational. The presence of search frictions does, of course, mean that this rationality is different from the rational behavior that one would see in models with perfect information. Even so, all agents are maximizing expected utility in their search, purchase, and sale decisions based on information that is updated in a way that respects the equilibrium strategies of other agents.

There is a small but growing literature that has considered departures from rationality. Shiller (1999) provided a comprehensive survey of various behavioral heuristics that agents might follow that are inconsistent with standard approaches to rationality. Genesove and Mayer (2001) presented data from Boston's housing market consistent with the presence of loss aversion, one particular behavioral heuristic.

Several recent papers have considered models that add a behavioral component to a search model. Piazzesi and Schneider (2009) showed how a small number of irrationally optimistic agents can generate positive momentum in housing markets. Burnside et al. (2011) calibrated a model where agents' contacts with each other result in changes in each other's beliefs and the beliefs in turn influence housing transactions. The model generates a situation where booms are sometimes but not always followed by busts, consistent with empirical observation. Peterson (2012) presented a model of search where agents incorrectly believe that the efficient market theory holds. The model is shown to replicate housing dynamics. See Glaeser and Nathanson (2014) for further discussion of behavioral models of bubbles.

13.3.9 Conclusion

The main conclusion of random matching models of housing markets is that search frictions fundamentally impact how the housing market clears. These frictions can explain the simultaneous existence of vacancies and households actively seeking to move. They can also explain the observed phenomenon of a positive correlation between

price and volume, something that would not necessarily be predicted in a simple competitive model of housing markets. They can also at least in part explain the volatility of housing markets. Finally, they call into question frictionless bid-rent models of housing and land markets. The next section will extend the analysis of search and matching by considering models with various kinds of search direction.

13.4. PRE-SEARCH, FOCUSED SEARCH, AND SEGMENTED SEARCH

It is not literally true that a buyer is equally likely to search all of the houses in a market. It is just as unlikely that a seller will encounter visitors who are random draws from an entire market. Instead, there is an initial round of "pre-search" based on information from advertisements that allows buyers to inspect only a subset of a market's houses (which can be conceived of as searching within a submarket). This section will consider models of this sort where pre-search activity gives richer microfoundations to the search models. Since the key issue here is how buyers obtain and make use of information in deciding on a search strategy, it is natural to begin by considering the most important new source of information, the Internet.

13.4.1 The internet and housing

The Internet has had a revolutionary impact on society, and these impacts have been felt in housing markets. While it is not possible to buy a house online in the same way that one buys a book, the Internet can certainly facilitate shopping. For instance, one can carry out preliminary investigations online, learning about house and neighborhood characteristics. While this is not costless since it takes time, and while the information gleaned from this kind of pre-search is not exactly the same as what a traditional visit would provide, it is obvious that the search process is impacted by this possibility.[15]

Several approaches have been taken to modeling the impact of the Internet. It provides lower cost search in Ford et al. (2005). It provides specific information in Carrillo (2008). It shifts the distribution of match values in Genesove and Han (2012a), Han and Strange (2014), and Williams (2014). All of these approaches can be thought of as modeling an initial stage of the search process, or pre-search.

Ford et al. (2005) documented the empirical relationship between listing a property on the Internet in addition to the standard MLS listing and sales price and seller time-on-market. The empirical analysis is motivated by search theory. The key assumption in the model is that the marginal cost of an additional search is lower for Internet-listed

[15] Of course, pre-search predated the Internet, with paper listings providing information on which visit decisions could be based. See Anglin (1997) for a useful discussion of newspaper advertisements and buyer search.

properties. The model has increasing marginal cost of search of both the online and conventional types, with the recall of previous listings a possibility. The model predicts that buyers will pay more for houses when they search on the Internet, a consequence of the improved match allowed by the superior learning technology. It also predicts that buyers will search longer on the Internet, again a consequence of the greater net benefit of such searches.

The model's predictions are taken to data on house listings. The key empirical exercise is the estimation of seller time-on-market and sales price in a simultaneous system. Since the choice of listing is endogenous, a selection model is estimated. The paper does not explain what exclusion restrictions would give identification, although for inverse Mills' ratio term, it is common to argue that identification comes from the nonlinear functional form of the selection model. The paper finds that properties listed on the Internet sell for more and take longer to do so.

Carrillo (2008) looked at the related issue of how the amount of visual information is related to market outcomes. Carrillo's analysis is motivated by Jovanovic's (1982) model of information unraveling. The idea is that there are good houses and bad ones, with only houses above a critical quality threshold choosing to provide an extensive virtual tour. His analysis yields a positive prediction of the relationship between sales price and visual information. It yields an uncertain prediction for seller time-on-market; more information might lead to more matches for some houses and to fewer for others. In his empirical analysis, Carrillo addresses the identification issue by adopting an instrumental variable approach to the property-level choice of how much information to provide. He employs two instruments, visual information in listings at the agent's firm and the visual information at nearby houses. His 2SLS results show a strong relationship between the provision of visual information and price, with a virtual tour adding 2% to price and 10 additional pictures adding 1.7%. Regarding time-on-market, which has a theoretically ambiguous relationship to visual information, the empirical relationship is strong and negative. Houses with more information sell more quickly, 20% more quickly in the case of virtual tours.

Genesove and Han (2012a) also had results on the Internet, although this is not their primary focus. This paper jointly considers buyer and seller liquidity in the context of a random matching model. The paper examines search over a period when the share of homes that buyers report as having found on the Internet rises from zero to roughly one-third. It shows in an Appendix how the Internet might impact search and matching where the use of Internet is endogenously induced by demand. The OLS empirical analysis shows that if all buyers find homes via the Internet, buyer time-on-market would be 24% greater and the number of home visited would be 30% greater than if none do. Seller time-on-market is insignificant. That buyers search more intensively when they have complementary information sources available is consistent with the search and matching model.

Finally, Han and Strange (2014) considered the impact of the Internet on the likelihood of a house buyer or seller participating in a bidding war with an above-list sales price. The paper shows that buyers who use the Internet are more likely to have purchased their houses through above-list bidding wars than other buyers. This is consistent with the Internet being an improvement in matching technology where matching improvements increase transaction volumes (Pissarides, 2000) and high transaction volumes are positively associated with bidding wars.

All of the papers discussed here have taken reduced-form approaches. The principal issue to address for future research of this sort is to find a way to achieve quasi-experimental variation in the use of the Internet to buy or sell a house. The difficulty with existing research in this area is that houses sold using the Internet or households searching through the Internet are different in unobserved ways from those houses and households who transact without the Internet. These unobserved characteristics could enter as errors in pricing equations or other models of interest, resulting in biased estimates.

The next section will consider a rigorous theory of how pre-search activities impact real estate markets.

13.4.2 Focused search

Williams (2014) develops a model of "focused search" that moves beyond a purely random search process. The key assumption in his focused-search model is that the pre-search results in a truncation of the distribution of idiosyncratic match values with the new truncated distribution being well approximated by a power law distribution.[16] The use of a power law approximation has been shown to have strong microfoundations in other applications. The approach here delivers sharp results. In particular, with the additional assumption of an isoelastic effort cost, the model generates explicit solutions for key variables in partial equilibrium and makes the analysis of the full steady-state equilibrium considerably more transparent.

The model is used to capture several important real-world aspects of real estate markets. For instance, it distinguishes in a serious way between the existing home market and the market for new construction. There are important empirical differences between these markets. Existing homes involve negotiation over price but do not allow an opportunity to customize. New houses allow customization, but typically do not allow negotiation. The paper characterizes equilibrium when sellers can allocate their search effort across multiple submarkets. The model and accompanying calibration fit some key

[16] See also Genesove and Han (2012b) for a related analysis of prescreening approach. They considered three families of extreme value distributions as well as the generalized Pareto distributions for the new distribution of the idiosyncratic matching value generated by a truncation of the original distribution of matching values.

stylized facts. Existing houses sell for more than comparable new houses. Buyers search less intensively among new houses but buy more frequently. The distinction here between new and old houses and the different opportunities they offer for customization is a feature of housing search that is not present, at least to a significant degree, in other sorts of search markets.[17] This is another example of how the analysis of housing search must respect the particular nature of housing markets.

13.4.3 Segmented search

The issue of market segments is explicitly addressed in Piazzesi et al. (2013). The crucial innovations in their housing search model are the presence of multiple market segments and heterogeneous clienteles.[18] Their approach makes use of search alerts provided to prospective homebuyers by trulia.com.[19] These alerts inform the buyers when houses meeting particular criteria are listed. They can, therefore, capture buyer tastes. There is a clear pattern of geographic segmentation in the raw data. The geographic segmentation is evidenced in three related ways. Buyers search zip codes that are not too far from each other (the maximum distance between the centroids of all zip codes searched has a maximum of 9.8 miles for a buyer who searches at least two zip codes). Buyers also search zip codes that tend to be contiguous and also that tend to satisfy circularity (searching within a distance of a critical location such as a workplace). There is also price segmentation and, to a lesser extent, segmentation by a house's number of bathrooms, which seems to capture a range of quality and quantity characteristics about which buyers have preferences.

Using this novel and rich data set, Piazzesi et al. found substantial variation not only for market outcomes across segments but also for clienteles within and across segments. In addition, inventory and search activity are inversely related across cities, but positively related within most cities. They then calibrated a version of the Diamond–Mortensen–Pissarides random matching model with multiple segments. In equilibrium, the cross-sectional distribution of turnover, inventory, price, and search activity is related to the distribution of preferences, matching technology, and moving shocks. In particular, the interaction of heterogeneous clients is shown to be quantitatively important for understanding housing market activity, measured by variables such as turnover, inventory, and seller time-on-market. The heterogeneity in these measures across market segments also means that the liquidity discount varies across market segments. In the

[17] The used-car market seems to have somewhat similar features. The labor market does not.

[18] Guasch and Marshall (1985) provided an early analysis of vacancies and marketing time across a segmented rental market.

[19] See Chauvet et al. (2014) for another creative use of search query data, the measurement of market movements. The use of online information in empirical research on housing has exploded in recent years. Such data appear to have the potential to at least partly resolve the greatest obstacle to research in this area, the absence of data.

calibrations, this variation is substantial, with more stable segments with fewer turnovers and more popular segments with low inventories exhibiting a much lower discount than other segments.[20] See also Landvoigt et al. (2013) for a related paper that presents an assignment model of continuous segmentation in San Diego's housing market. The results are consistent with the relaxation of credit contributing to San Diego's housing boom, especially at the low end of the housing market.

Liu et al. (2014) is another paper that has considered market segmentation. It takes a dynamic approach and defines segments by house size. The empirical work uses Phoenix data. The key empirical finding is that all size segments moved together during the boom, but during the bust, there is a strict hierarchy of declines, with smaller properties declining more quickly.

This section has considered how and where buyers allocate their search effort and how this affects housing market activity and transaction outcomes. The next section will consider the strategic actions of sellers.

13.5. DIRECTED SEARCH FOR HOUSING

With directed search, an agent uses price to influence the matching process. The previous section discussed models where agents choose how intensively to search and where to allocate their search efforts. With directed search, the seller commits to a price, and this plays an important role in the agents' search choices and the matching that ensues.

Peters (1984, 1991) presented seminal directed search models for goods markets. The former shows how search frictions and capacity constraints can resolve the well-known discontinuity in payoffs in Bertrand pricing games. The latter compares *ex ante* price commitments with negotiation in a search and matching setting. It shows that a seller can profit from setting an *ex ante* price when all other sellers are choosing not to do so, a result suggesting the instability of failing to post prices.

Most of the directed search literature is in the context of labor or commodity search. See Rogerson et al. (2005), Rogerson and Shimer (2011), and Shi (2008) for recent surveys. The issues that are most important for our purposes are as follows. First, the posted price impacts search. Second, the equilibrium posted price under some circumstances gives efficiency in the sense of producing a ratio of buyers to sellers in steady state consistent with the Hosios (1990) condition on market efficiency. This efficiency was absent in random matching models without direction, where the Hosios condition prescribes a buyer–seller ratio that will be obtained only accidentally. One version of this result is

[20] It is worth pointing out that the working paper of Levitt and Syverson's (2008a) agents report results on the relationship between property characteristics reported in advertisements and sales price and marketing time. This can be interpreted as descriptive evidence on segmented search that is complementary to Piazzesi et al.

found in Moen (1997) and Shi (2001). Third, unemployment and vacancies are simultaneously present in equilibrium. There is very little recognition in this literature of the unique characteristics of housing.

Should we expect these results to extend to housing? Our answer to this question is mostly, but not entirely. Search is an appropriate model of trading frictions, and housing vacancies and more generally illiquidity can be understood by modeling frictions through search. However, housing has important institutional differences, including the use of intermediaries (much more common with housing), that the same agents are both buyers and sellers on the market and the complicated role of asking price. So one can make use of labor search to understand housing markets, but modification is required. Put the other way, the analysis of housing search has the potential to add to the general literature on search.

We now turn to models that deal with the specifics of housing.

13.5.1 Asking price as a strategic instrument

There are two ways that asking price might impact the sales price of a house in a search setting. First, once there is a meeting, asking price may impact the bargaining between buyers and sellers. This is considered by Yavaş and Yang (1995). In their model, a high list price will result in a higher sales price if an agreement is reached, but it will reduce the probability of sale. Among the empirical findings of this paper is that an overlisted house, one with a high list price relative to a hedonic estimate, will sell for more but take longer to do so.

The second impact of asking price is to encourage search. Yavaş and Yang did not consider this effect. Horowitz (1992) did, in a model where the list price is a ceiling and visits are encouraged by a low list price. The latter is not given microfoundation. His structural estimation of this model shows that reductions of list price are not likely to do much, which he interprets as explaining the empirical regularity that list price is infrequently adjusted. Merlo et al. (2013) made the point that this result is an inherent feature of a stationary search framework such as the one that Horowitz employs. As discussed below, Merlo et al. provided an explanation for the stickiness of list price in a nonstationary framework.

13.5.2 Asking price as a commitment

Chen and Rosenthal (1996a,b) presented models where asking price directs search by operating as a commitment mechanism. The simplest version of these models is as follows. A seller sets an asking price. Buyers choose to visit, and those that do learn their idiosyncratic match values. The seller also learns the match value (as in other games where the after-meeting price is determined by bargaining). The seller sets a take it or leave it price. This price is assumed to be constrained by the asking price.

The key result is that search can be encouraged by setting a low asking price. The result extends but in weaker form when the bargaining power is split between the buyer and seller. If the buyers have enough bargaining power, then a commitment through the asking price is not needed to encourage search.[21]

Instead of employing the standard Nash approach to bargaining, Arnold (1999) employed a Rubinstein (1982) bargaining game for the determination of prices. In this subgame, the asking price is, as in Chen and Rosenthal, a ceiling on price. This generates a trade-off similar to Chen and Rosenthal, with a lower asking price attracting additional visitors but resulting in a lower sales price as a negotiation outcome. The key difference in Arnold is that discount rates and outside options impact the transaction. In Arnold, as in Chen and Rosenthal (1996a,b) and Green and Vandell (1998), asking price is modeled as a ceiling. But the asking price is not really a strict commitment. How does it matter in this case?

13.5.3 Asking price as a partial commitment

Although asking price is not a binding ceiling, it does seem to matter. One way to see this is to note that although houses sell for both less and more than their asking prices, a notable share of housing transactions ends with the price exactly equal to the asking price (Han and Strange, 2014). In other words, asking price is accepted at least some of the time. This is documented although not commented on in several waves of surveys by Case and Shiller (1988, 2003). Han and Strange (2014) provide further documentation using more than two decades of surveys by the NAR and more recent surveys in one market. So although it would be incorrect to model a home seller's asking price as a simple posted price (as with a good), it would also be incorrect to see the asking price as being meaningless.

This leads to two questions, one theoretical and one empirical. The theoretical question is: how can one rationalize in a fully specified equilibrium model how asking price can direct search even though it is neither a posted price nor a ceiling? The empirical question follows naturally: how does this kind of partial commitment impact search and housing market outcomes in various stages of the real estate cycle?

Han and Strange (2014) present a model showing how asking price can impact housing transactions even though one observes sales prices above, below, and equal to asking price. The heart of the model is as follows. Suppose that buyers have a two-point distribution on the match utility from a particular house. Suppose the asking price is a partial commitment in the following sense. When all buyers have match utility less than asking price, then sales price is determined in a Nash bargain. When two or more buyers have match utility greater than asking price, then sales price is determined as in an auction (we will discuss auctions further below). When exactly one buyer prefers the asking price to

[21] See Lester et al. (2013) for a demonstration that a ceiling asking price is an efficient mechanism.

the price that would come from a Nash bargain, then the sales price equals the asking price. In this case, the seller will use the asking price to encourage visits. The seller's trade-off is between the surplus that is sacrificed in the acceptance case and the greater likelihood of the profitable bidding war case.

Han and Strange (2014) provide empirical evidence consistent with this role. The analysis is unusual in making use of data on buyer search behavior and not just on aggregate outcomes such as price and time-on-market. Several results emerge. First, a lower asking price increases the number of bidders on a house (a subset of the number of visitors). Second, asking price has a stronger negative relationship with search activity in a bust than in a boom. Third, the asking price performs this directing role even though housing is clearly not a posted-price market, with houses sometimes sold below list, sometimes above list, and sometimes at list.

13.5.4 Asking price as a signal

Albrecht et al. (2012) offered a directed search model that also has the realistic feature that sales price can be below or above asking price. They begin with a one-period model where all sellers are identical. Buyers choose which houses to visit, with the visit revealing to the buyer the idiosyncratic match value of the house. Buyers then bid, with this initial bid between the reservation price of the seller (assumed to be known to buyers) and the asking price. If no buyer bids at or above asking price, then the house is sold to the highest bidder at the bid price. If exactly one buyer bids at the asking price (which means that all others bid less by construction), then the house is sold at the asking price. If more than one bidder bids the asking price, then there is a second round that proceeds as an English auction. It is assumed that buyers make visit decisions without knowing how many other buyers might have chosen to visit a given house. In this homogeneous seller setting, it is possible for sales price to be below, at, or above asking price in equilibrium. A seller's revenues are independent of which of these marketing strategies is followed.[22]

Now suppose sellers differ in motivation (reservation price). In this case, asking price can signal motivation. With two types of seller, we will have two asking prices, one higher for the less motivated sellers and one lower for the more motivated sellers. A more motivated seller will have more visits, giving a higher probability of sale (capturing liquidity in this model). The price conditional on sale will be lower, however. In both cases, the equilibrium is efficient, as in labor models.

13.5.5 Directed search and bargaining

Merlo and Ortalo-Magné (2004) documented the housing transaction using an unusual data set in a way that sheds considerable light on directed search. Their data cover fewer

[22] See also Wang (2011) for another model of how list price can signal quality.

than 1000 transactions from three London area real estate boards during a time of market stability. However, the data include information on a number of features of the housing transaction that are usually not documented. The data record all reductions in asking price and the time of reduction. They also record all offers that are made. In the English institutional setting, this amounts to recording the entire history of negotiations, since sellers in England do not typically make counteroffers as they would in North America. So in addition to working with sales price and time-on-market, as is typical, Merlo and Ortalo-Magné were able to characterize the microstructure of the transactions in their sample.

Using these data, Merlo and Ortalo-Magné showed that a high list price is associated with a high sales price but a slower sale. List reductions are observed most frequently for houses that have not previously attracted much interest as measured by offers. Houses frequently sell to the first buyer who makes an offer, but one-third of matches that have led to offers fail to lead to a transaction.

This paper is an excellent example of the sort of impactful contribution that can be made using new and idiosyncratic data sources. Prior work typically used data that reported asking and sales price and also time-on-market for sellers. Such traditional data reported almost nothing about either search activity directly (i.e., numbers of visits) or the bargaining process (i.e., offers and counteroffers), especially in cases where a meeting did not result in a sale. And traditional data are almost completely silent on buyer search activity. There is a strong case for the creation of new data such as those used by Merlo and Ortalo-Magné or making use of new Internet-based data such as in Piazzesi et al. (2013).

13.5.6 Structural approaches to directed search

Carrillo (2012) specified and estimated a stationary equilibrium search model of the housing market. His model incorporates two important features of the real estate market: heterogeneity in the buyer's and seller's motivation to trade and the directing role of the asking price. Note that in his model, houses never sell above their asking prices because by assumption, there is no *ex post* competition among buyers. The model is estimated using the MLS data for real estate transactions in Charlottesville City and Albemarle County, VA, in 2000–2002. He found that more than half of the buyer's home valuation is gathered at the time when a listing is viewed. In addition, the model is used in two applications. First, it is used to evaluate the information content of visits and to determine the impact of previsit information, issues that are obviously central to search theory. Second, he also considered the impact of the structure of agent compensation. Counterfactual experiments show that the asking price and sales price are both reduced when there is additional online information about listings or when the commission rates are reduced.

Merlo et al. (2013) took a structural approach to solve a series of decision problems that a home seller faces: which price to list the house at initially, how to revise this price over time, whether or not to accept the offers that are received, and whether to withdraw the house if offers are not sufficiently attractive. They formulated these decisions in a finite-horizon, dynamic programming model, taking as given the seller's expectation about the probability a potential buyer arrives and makes an initial offer, the probability she will make additional offers if being rejected, and the level of the offer prices. Since they calibrated the arrival and negotiation process using UK data (as in Merlo and Ortalo-Magné, 2004), they adopted the UK institutions. An important feature is that there are no seller counteroffers, meaning that negotiation involves some number of buyer offers, each of which the seller must choose to take or to leave. These empirically fitted automata are then employed to estimate a seller's optimal dynamic sales strategy.

A number of interesting results emerge. First, small menu costs result in rare adjustments of asking price (contrary to Salant's theory, where asking price is adjusted every period). Reservation price, however, does adjust over the sales period. The kind of structural approach taken in this paper seems like a very promising path toward a deeper understanding of the micro behavior of house buyers and sellers. Of course, this estimation requires data that are much richer than are usually available. It includes not just the usual outcome variables (asking price, sales price, and time-on-market) but a number of process variables (individual offers made by buyers and asking price revisions).

While both Carrillo (2012) and Merlo et al. (2013) explicitly allowed buyers to direct their response to sellers' asking price, their approach on modeling the bargaining process is highly stylized. In the former case, trade occurs either at the asking price or at the seller's reservation value; in the latter case, buyers are treated as bidding automata and the offer process is one-sided. In both cases, sellers interact with only one buyer at a time. This prevents *ex post* competition among buyers for a seller's house—a point that we will come back to in Section 13.6 where we discuss auctions.

13.5.7 Directed search and booms and busts

In Section 13.3, we discussed some quantitative models of random matching. Díaz and Jerez (2013) computed a quantitative model of directed search. It allows the determination of the magnitude of the effect of housing search frictions on the housing cycle. This calibration exercise includes a wide range of general equilibrium effects. The results are consistent with housing frictions amplifying shocks and producing greater volatility.

In a similar vein, Caplin and Leahy (2011) considered how a directed search model can generate the key qualitative characteristics of housing market dynamics. They noted that a basic search model can generate volatility, a price–volume correlation, and a negative correlation of inventory and price. A basic search model fails, however, to generate the positive autocorrelation in price found by Case and Shiller (1989). This requires a

modification, such as information frictions where agents do not know the state of the market. In Caplin and Leahy's analysis, bargaining power changes endogenously over cycle (unlike other models, such as Wheaton, 1990).

13.5.8 Housing search and labor markets

We have thus far focused on housing frictions. Housing markets are, of course, related to labor markets, and labor markets have frictions too. This raises the possibility that the two sorts of frictions interact with each other. The idea that homeownership might be negatively related to labor market flexibility is often attributed to Oswald (1997). This empirical relationship can be given a search-theoretic foundation. Owners move less than renters, implying that changes in the location of a worker's ideal job may result less frequently in relocation for owners than for renters. In some situation, this may result in labor market mismatch.

Evidence on the Oswald Hypothesis has been mixed. Coulson and Fisher (2002) showed that in cross section, owners do not have inferior labor market outcomes to renters in an OLS framework. In Coulson and Fisher (2009), the result is shown to extend for the most part to instrumental variation. They attributed the absence of an Oswald effect to the adjustments of firms. On the other hand, Munch et al. (2008) established a negative relationship between homeownership and job mobility in Denmark. Likewise, Battu et al. (2008) showed that both ownership and residence in public rental housing can discourage mobility. The latter confers a kind of tenure whose security and duration approach that of ownership.

Head and Lloyd-Ellis (2012) offered a resolution. They presented a directed search model of the interaction between labor and directed housing search. The illiquidity of housing produces frictions in the labor market as well, with the rate of accepting out-of-town job offers being lower than the rate for job changes that would not require a home sale. A calibration shows the effect of homeownership to be small with a relatively small rate of unemployment. However, when unemployment is large, housing illiquidity has an economically significant effect.

13.6. AUCTIONS

We have thus far dealt with sequential search where buyers and sellers are matched one to one. In auctions, the matching is multiple. In this case, the bargaining that takes place is no longer a one-to-one process of negotiation. An auction may sometimes involve many buyers bidding for a single house. It may instead involve many buyers bidding for many housing units (typically condominiums). This section will deal with these auctions.

Our first point on this topic is that auctions happen. There are English auctions for houses in Australia (Lusht, 1996). There are auctions with sealed bid characteristics in Scotland (Pryce, 2011). And there are multiple object auctions as well (Ashenfelter

and Genesove, 1992). Auctions take place in both the single-family residential and the multifamily markets. They also take place in nonresidential markets and also in the land market (Quan, 1994, discussed many areas where auctions have been used).

In fact, auction-like transactions have become considerably more common during the great boom of the 2000s, and they have retained much popularity during the bust. We are referring here to the so-called bidding wars, where multiple buyers compete against each other for a property, typically very soon after listing.[23] While standard data sources almost never document the bidding for a house, one can infer the presence of competing bids when a house sells for more than its asking price. Han and Strange (2013) showed that the fraction of above-list prices was a fairly constant 3–5% prior to 2000. It grew to a national average of roughly 15% in 2005 before by about half in 2008. The low figure is consistent with Merlo and Ortalo-Magné (2004), whose unusual data do report bids, while the high figure is consistent more recent data reported in Han and Strange (2013). In some markets, bidding wars became much more common (roughly one-third of sales). These transactions involve bidding in an informal auction. An auction is not guaranteed, however, and many house sellers who hope for auctions must ultimately sell through the traditional sequential mechanism. This has led to the phenomenon of "backup offers" (discussed in Ashenfelter and Genesove, 1992; Quan, 2002; Ooi et al., 2006). In this situation, the distinction between auction and sequential sale is at least somewhat fuzzy.

The existence of auctions leads naturally to two important and related questions: How do auctions perform relative to more traditional sequential sales mechanisms? What determines when an auction is chosen or whether one arises naturally?

13.6.1 Theoretical issues

There is a vast literature on auctions as a general phenomenon. Krishna (2009) is a comprehensive reference. A buyer's participation in an auction is central to the outcome it delivers. Such participation is costly. McAfee (1993) and Peters and Severinov (1997) are classic references on competing auctions where the competition takes place through posted reserve prices. Albrecht et al. (2012) considered efficiency in this setting. Wang (1993) examined the related issue, the relative performance of auctions versus posted-price sale in a private value setting. Buyers arrive randomly with random match values. If the seller chooses to post a price, then a transaction will occur when a buyer arrives with a sufficiently large valuation. An auction, in contrast, involves choosing a critical time, with all buyers arriving before that time allowed to participate in the auction. The seller incurs costs under both mechanisms while waiting for a sale. The seller also incurs a fixed cost of holding an auction. Wang showed that an auction generates greater revenue when this auction cost is zero. Even with a positive auction cost, an

[23] Pryce and Gibb (2006) showed that booms are associated with an increase in the number of buyers competing for a house in Scotland, where the system more closely resembles an actual auction.

auction generates greater revenue when the marginal revenue curves defined by buyer valuations are sufficiently dispersed.

Bulow and Klemperer (2009) considered why sellers might prefer auctions. They noted that the simple answer that auctions deliver competition and thus high prices is not entirely satisfactory, since a sequential sales mechanism also confronts a buyer with competition from future rival buyers who may arise. In Bulow and Klemperer's model, sequential search is efficient in the sense that it encourages buyer visits (participation) precisely when such visits are most valuable: when prior buyers had low valuations. Auctions, in contrast, are inefficient, with many buyers making participation decisions without information regarding other buyers' match values. Because of this, auctions give more dispersion in outcomes. This dispersion encourages buyers to participate, which in turn is why in most situations, sellers prefer auctions. The key exception noted by Bulow and Klemperer is when buyers cannot issue credible "jump bids" that preempt further search activity. In this case, it is possible that a sequential process would give a higher price.

The literature on real estate auctions is small, especially on the theoretical side. See Quan (1994) for a discussion of the implications of general research on auctions for real estate. Adams et al. (1992) modeled real estate transactions as a "slow Dutch auction." In this setting, when a house seller faces a stationary environment, it is optimal for the seller to maintain a fixed asking price, and it is never optimal for the seller to terminate the process by calling an auction. Mayer (1995) pointed out that this result requires stationarity. In his model, auctions deliver rapid transactions but at a discount. In a down market, the auction discount will be steeper. With seasonality (as in Salant, 1991), the optimal price may fall over the marketing period and an auction may deliver a higher price than a sequential mechanism. Quan (2002) presented a model with an additional element. Buyers, like sellers, can differ in their taste for a rapid transaction. Buyers are willing to pay more to avoid a lengthy period of search. Sellers are willing to accept less.

13.6.2 Empirics

13.6.2.1 Auctions and outcomes

A number of papers have considered the empirical relationship between the use of an auction instead of a sequential sale mechanism and the price of a house. Lusht (1996) considered this issue in the Australian setting where auctions are common. Controlling for a house's characteristics, he found that houses sell for more at auctions. Of course, the choice to auction is endogenous, and this could produce biased estimates of the auction coefficient if unobserved house characteristics that buyers value are correlated with the decision to auction. Quan (2002) found a premium for auctioned properties even using a method-of-moments approach to control for unobserved heterogeneity. Mayer (1998), in contrast, found a discount for auctions using a repeat sales estimator to control for endogenous selection into auctions. This is explained as reflecting the seller trade-off

between price and liquidity. Chow et al. (2014) help to explain these disparate results by showing that the difference between price under auction and that under negotiated sales depends on property type and market condition. They show that the auction premium is larger for more homogeneous properties and in booms.

All of these papers consider the impact of auctions within small data sets. Campbell et al. (2011) considered the effect of a "forced sale" on price in a very large data set. Their goal in this regard is to use quasi-experimental variation in the type of sale—forced or not—in order to assess the liquidity discount.[24] They did this by obtaining data on deaths and delinquencies, both circumstances that transmit the property to another owner who is likely to be mismatched with the housing unit and therefore motivated to sell. They found a forced sale discount of 3–7% across all forcing events in OLS models. However, there is reason to be concerned that the characteristics of the housing unit are related to the circumstance forcing the sale. An older household may not maintain a house in the same way that a younger one would, for instance. They addressed this concern by estimating models for different forcing circumstances, for different ages of owner, for different types of property, and separately for the structure and land components of property value. They found evidence consistent with the discount associated with death being "primarily" associated with unobserved housing characteristics. They did not find this for mortgage foreclosures or bankruptcies. In these cases, they concluded that prices of forced sales are indeed lower.

13.6.2.2 Bidding wars

As noted above, formal auctions remain rare for nondistressed single-family houses in North America. They are also uncommon in the nondistressed multifamily residential market. However, informal auctions do take place. With "bidding wars," a house (typically newly listed) is sold in a process of competitive bids made by rival buyers. The exact institutions are variable. In Toronto, written bids are presented at a particular time, typically accompanied by a presentation by the buyer's agent. After all bids, the seller typically involves some or all of the initial bidders to bid again. This can be repeated. Buyers usually are told the number of other bidders before they submit the bids. While a bidding war clearly is a sort of auction, it is not one of the standard forms. In Washington, DC, the process is more formal. Bids are submitted with escalators specifying how high the bidder will go. Buyers usually do not learn of the number of other bidders or the bids. These bidding wars are much more common than they used to be. As noted above, the share has more than doubled between the late 1990s and the early stages of the housing recovery. The fraction of sales taking this form varies significantly across space.

[24] An equally important goal is to understand the effects of foreclosures, a particular type of forced sale, on housing markets. This is not our central focus in this chapter.

Han and Strange (2013) considered the determinants of bidding wars. The analysis shows that the share of bidding wars is procyclical. There are also more bidding wars with greater Internet adoption. Sales with price greater than list are shown to occur early in a house's sales period. This does not, of course, mean that sellers can use informal auctions like this to achieve both high prices and low seller time-on-market.

All of this makes clear that a seller does not typically decide between auction and sequential search. The decision is made by the market. The seller may influence this by strategically marketing the house. A credible commitment to a low list price may perform this role. Some houses may attract enough interest to sell at a high price and soon. Others may not. It is likely that at least some of the premium that is associated with auction and auction-like transaction mechanisms reflects this sort of unobserved heterogeneity.

Or it may reflect something quite different. Ashenfelter and Genesove (1992) considered the possibility of behavioral anomalies influencing real estate auctions. This possibility is clearly present in popular discussions of bidding wars, with folklore suggesting that a low listing price to bring people to the table can result in a high sales price as bidders throw caution to the wind in the ensuing auction.

To consider this possibility, Ashenfelter and Genesove (1992) worked with data from a small multiobject "pooled" auction. In such an auction, the highest bidder chooses a property first. In such a model, price will be lower for later units since they will be inferior in a revealed preference sense. Since units are resold after bargaining, one can address the omission of characteristics by looking at how private sale prices relate to the time of sale within an auction. Their results are surprising. They found prices of condominiums sold at auction were 13% higher than prices for identical units sold through postauction bargaining. These units were actually the same properties, rather than being identical in the hedonic sense of having identical observed attributes. This is interpreted as a possible instance of winner's curse. If buyers are behaving irrationally in this way, then sellers could profit from choosing auctions. Of course, it is unclear how such a strategy would hold up when enough sellers used it and buyers became aware of it.

The increasing popularity of bidding wars in recent years also permits an opportunity for researchers to empirically measure the thinness of the housing market. Even a casual acquaintance with the market, such as most people's experience of buying or selling a home, would attest to the essential thinness of the housing market—the variability in the match quality between buyers and sellers and the inability of buyers to find suitable sellers and vice versa without making costly efforts, which underlie all search and matching models. However, the thinness itself, despite its intuitive appeal and fundamental importance, is neither easily defined nor readily measured.

Employing a recent survey that collects information about home search, bargaining, and bidding process in a large North American metropolitan area in 2005–2009, Genesove and Han (2012b) estimated market thinness in two ways. First, controlling

for observed and unobserved heterogeneity among housing units, doubling the number of bidders increases the sales price by 2.4%. This effect is statistically significant. This is contrary to the hypothesis of a thick market in which buyers' valuations are homogenous and so the sale price is invariant to the number of bidders. Second, the spread of bidders' valuations for a given house, measured by the standard deviation of the underlying distribution, falls within the range of 4–5% of home value. Intuitively, if homes are not very different one from another, one buyer will evaluate a given house pretty much the same as another. The enormous estimated buyer valuation variance for a given home provides a clear demonstration of how thin real estate markets are.

13.7. REAL ESTATE BROKERS: FUNDAMENTALS

A large fraction of search, matching, and bargaining in the housing market is facilitated by real estate brokers and agents.[25] This section begins to consider the role of intermediation in real estate transactions. It describes the activities of real estate brokers, and it discusses why they play the role that they do. Later sections consider the nature of competition and entry in the brokerage industry, the incentive issues that impact broker performance, and the efficiency of resource allocation in this sector. In other words, the chapter now moves on to consider the intermediation factors discussed in Figures 13.1 and 13.3.

13.7.1 The activities of real estate brokers

One key difference between intermediaries in the financial and commodity markets and intermediaries in the real estate markets is that the former are dominated by market makers, while the latter are dominated by matchmakers. According to Yavaş (1994), a market maker sets an asking price and a bid price at which she buys and sells for her own account. Examples include specialists in the stock market and dealers in the used-car market. In contrast, match makers create meetings between the buyers and the sellers rather than participating in the trade themselves. One interesting phenomenon is that real estate markets typically only have the second type of intermediary, but not the first.[26] Anglin and Arnott (1991) attributed the absence of dealers in the real estate market to high inventory cost and the risk associated with houses. Using a search-theoretic model, Yavaş (1992) showed that the search costs associated with

[25] As noted in Section 13.1, we use the terms "broker" and "agent" interchangeably.

[26] There are, however, exceptions. For instance, there are "flippers," who hold housing for speculative reasons, as documented by Bayer et al. (2011). As of now, this class of intermediaries is not commonly involved in housing transactions, possibly because of transfer taxes, holding costs, and other related barriers to this form of intermediation. Furthermore, there seem to be cases when a broker will buy a house and then later return the house to the market.

finding trading partners help to explain the dominance of brokers over dealers in the housing market.

More specifically, real estate agents and brokers are licensed professionals whose main job is to match a home seller with a homebuyer. Together, they provide a bundle of services to buyers and sellers. An agent working with buyers is often referred to as the "cooperating agent" or "selling agent." Cooperating agents typically attempt to find houses that match buyers' tastes, show buyers prospective homes, advise them in making offers, and provide assistance in the negotiation process. An agent working with sellers is often referred to as the "listing agent." The listing agent helps sellers list the house on the MLS, assists sellers in staging and marketing the house, advises sellers on the listing price, helps sellers evaluate offers and formulate counteroffers, helps negotiate directly with the buyer or the buyer's agent, and provides assistance in closing a transaction. In North America, the listing agent is commonly contractually granted the exclusive right to sell. Typically, the cooperating agent is legally considered to be a subagent of the listing agent.[27]

It is common for agents to receive their compensation as a fixed percentage of the sales price of a home. In North America, it is typical for the commission to be 5–6% of the sale price. The listing agent shares equally with the cooperating agent who brings the buyer to close the deal. Both agents further split commission fees with their affiliated brokerage offices, in return for the brand value and for the supporting services that brokerage offices provide.

It is important to recognize that the North American situation is not universal. In England, a commission of 1–2% is more common, for instance, and there is only one-sided seller representation. Furthermore, while contracts in North America typically specify exclusive representation by a single broker, sellers in England can choose to pay a higher commission, perhaps 2.5–3%, and be represented by multiple agents. In Vancouver, the contract is not even linear. The typical real estate commission is 7% of the first $100,000 and a lower percentage (usually 2–3.5%) of the rest of the sales price.[28]

The compensation structure and the nature of competition in the real estate broker industry have been the subject of extensive prior research, and excellent surveys already exist for the interested reader (see, e.g., recent surveys by Yavaş, 1994; Benjamin et al., 2000; Miceli et al., 2007; Zietz and Sirmans, 2011). For our purposes here, we will not reproduce this discussion but rather focus on the more narrow, but crucial, topics of search intermediation, competition and efficiency, and information economics.

[27] In commercial real estate, there is typically only one agent.

[28] A lower commission for the marginal dollar of house value makes the contract even more low-powered than with linearity. This is unlikely to improve agent incentives.

13.7.2 Why do real estate brokers exist?

According to a survey conducted by the NAR in 2005, 84% of single-family house sales in North America are facilitated by real estate brokerage. However, as illustrated in Sections 13.2–13.6, neither buyers nor sellers must use real estate agents; counterparties can approach each other directly in housing markets. Thus, the most basic question regarding real estate brokers is: why do they exist?

The consensus of the literature is that real estate brokerage emerges mainly due to imperfect information. For example, Yinger (1981) stressed the importance of information in a search-theoretic framework. He discussed three types of uncertainty. There is uncertainty about the number of buyers, the number of listings, and the number of matches. In this setting, Yinger showed that the existence of MLS improves outcomes and thus confers a competitive advantage on member brokers. Wu and Colwell (1986) extended Yinger's model to incorporate the behavior of buyers and sellers. Yavaş (1992) further extended this line of literature by incorporating the bargaining stage into the model. In an elegant search-theoretic model, Yavaş showed that a search economy without brokers involves two sources of inefficiency. First, as with Yinger, brokers are better informed. Second, as with many search models, there are positive externalities. An increase in the search efforts of either a buyer or a seller increases the probability of a match, hence the payoff for the counterparty. Because neither takes into consideration the effects of own search on the additional gains to the counterparty, this positive externality results in less search activity than would be in the joint interest of the two agents. These inefficiencies create a situation where real estate brokers can potentially reduce the uncertainty and internalize some of the externalities in return for some profits. Thus, one reason for real estate brokers to exist is that they create value by resolving information problems.[29]

The informational need for an intermediary is further exacerbated by a set of intrinsic characteristics of housing: necessity, heterogeneity, indivisibility, complexity, high stakes, and transaction costs (Arnott, 1987). These characteristics interact to make it costly for buyers and sellers to find the right trading partners and to reach agreements on house prices. In particular, the multidimensional heterogeneity of a house, combined with the multidimensional heterogeneity of buyer tastes, renders the housing market thin. In a thin housing market, even with many house units available for sale, it can be difficult for a buyer to find a house that matches his preference. Moreover, unlike participants in financial securities markets, most homebuyers and sellers have very limited experience in trading a home. Households typically buy and sell a small number of houses over a lifetime because of the high transaction cost associated with buying and selling a house

[29] See Kurlat and Stroebel (2014) for strong evidence that there exist information asymmetries in real estate. While their analysis does not focus primarily on the role of real estate agents, some of their analysis is based on the idea that brokers operate with less uncertainty.

(Haurin and Gill, 2002). In addition, given that house is the largest financial asset in a typical household's portfolios (Tracy and Schneider, 2001) and given that house price risk is not readily diversifiable (Caplin et al., 1997), the cost of a mismatch in the housing market tends to be particularly large.

Together, these features imply that search frictions are substantial. With their information advantage relative to homebuyers and sellers, real estate brokers can potentially improve the function of the market by dispersing information and creating a more coordinated matching scheme. Thus, a natural question to ask is what gives real estate brokers better information? In what follows, we discuss two potential sources.

The first is their superior access to MLS, which gives brokers better information. As Stigler (1961) had shown, the acquisition of information about the state of the market can absorb significant resources. This is particularly so for housing markets given the frictions described above. For any given housing transaction, there are advantages to having a centralized depository of information that summarizes offers to sell (listings).[30] Such information helps buyers to expedite the process of search and helps sellers to determine an initial asking price. By actively collecting and dispersing such information through MLS arrangement, real estate brokers can potentially reduce the frictions in the housing market and ameliorate the problem of imperfect information, permitting a more efficient search and bargaining process. As noted above, the impact of MLSs on the search strategy of buyers and sellers and brokers has been analyzed in detail by Yinger (1981) and Wu and Colwell (1986).

Of course, this situation has changed significantly with the spread of the Internet. This allows buyers to see active listings on the MLS. Furthermore, there are online resources such as Trulia and Zillow that can also help participants better understand the state of the market. However, it should be noted that brokers continue to have exclusive access to data on historical completed transactions. These data include information on sales price and time-on-market of previously completed transactions, rather than just the list price that is reported on an active listing. Thus, even as of this writing, the MLS confers a significant information advantage to brokers.

The second source of the real estate brokers' information advantage comes from the experience gained through their professional activities. Unlike a typical homebuyer or seller who is involved in a house transaction only a few times, an established real estate agent has been involved in many real estate transactions. This experience helps brokers build expertise in understanding market conditions and handling the financial and legal complexities involved in completing a real estate transaction. This expertise is valuable for homebuyers and sellers as the high stakes associated with risky housing transactions mean that mismatch can potentially be very costly. Quite naturally, the value of real estate

[30] An interesting question is why there is not a centralized depositary of information that summarizes a list of potential buyers.

brokers should be particularly large for unsophisticated buyers and sellers with limited knowledge and experience of housing markets. Consistent with this, Benjamin et al. (2007) found that brokers are more likely to be employed by those with less knowledge about housing transactions.

The information benefits associated with real estate brokerage do not, however, come without cost. First, the commission fees that brokers charge create a spread between buying and selling prices. This could potentially prevent mutually beneficial transactions from taking place.[31] It is parallel to what has been called excessive intermediation in other financial markets. In a market without agents, a seller and a buyer would trade with each other only if the latter's valuation of the house exceeds the former's. With agents, they will trade only if the difference between their valuations exceeds the commission fees that they have to pay the agent, which creates an additional friction. Thus, whether brokers can enhance welfare depends on whether the transaction cost they impose is lower than the benefit they bring by economizing on search costs. Jud and Frew (1986) and Yavaş (1992) showed that the seller receives a higher price when employing a broker, but the increase in price is less than the commission. This seems to suggest that the spread, the brokerage commission, might be large enough to be a significant barrier to transactions. However, brokerage may also improve liquidity and match quality while allowing buyers and sellers to choose lower search intensities and thus incur lower search cost.[32] The welfare economics of the commission spread are, thus, quite complicated, depending on commission fees, search costs, and matching technology.

Second, with a market structure characterized by weak price competition and free entry, there will be a tendency for excessive entry. The ensuing inefficiency can take the form of inefficient scale in that there are too many brokers. It could also take the form of a broker spending too much search effort to compete with other brokers for new listings. Such effort might have private value to a broker but no value to clients and other brokers and therefore can considered to be socially wasteful. This point will be further illustrated in Section 13.8.

Third, the information advantage that real estate brokers possess relative to buyers and sellers also raises the possibility that these agents may behave strategically. A broker's interest in maximizing commission revenues could cause a series of incentive alignment problems, which could introduce noise into the home search process and lead to a substantial welfare loss for the clients they work for. We will elaborate on this point in Section 13.9.

[31] It is typical for jurisdictions to impose taxes on transactions, which further increases the spread between the price a buyer pays and the price a seller receives. Dachis et al. (2011) showed that this discourages transactions. In a similar vein, weaker property rights in a developing economy would also result in a lower expected payoff from search and in less search and fewer transactions.

[32] See Yavaş (1994) for a theoretical demonstration that equilibrium search intensities fall when brokers are employed.

13.8. COMPETITION IN THE RESIDENTIAL REAL ESTATE BROKERAGE INDUSTRY

The brokerage industry is the subject of vigorous policy debate. A key question in this debate is whether this market is truly a competitive one. This section considers competition in brokerage from both positive and normative perspectives.

13.8.1 Nature of competition

A report by the National Association of Realtors (2005), NAR, provides an economic analysis of the structure, conduct, and performance of the real estate brokerage industry. The report argues that the industry is fiercely competitive, evidenced by the large number of brokerage firms and agents, the low concentration ratio in the brokerage market, and the ease of entry into and exit from the profession. For example, according to FTC (2007), there are approximately 98,000 brokerage firms operating over 200,000 local offices in the United States. These offices provide potential employment for approximately 2.5 million real estate licensees. The NAR further reports that in 2004, the top 10 brokerage firms have a combined market share of 9.1%, the top 20 firms have a share of 10.9%, the top 100 firms have a share of 17%, the top 500 firms have a share of 26.6%, and 96% of brokerage offices employ 10 or fewer real estate agents.

A related strand of the literature argues that the competitive nature of the brokerage industry is also evidenced by the absence of cost inefficiencies. For example, papers by Anderson et al. (2000a,b,c) look at X-efficiencies and conclude that the performance of real estate brokerage is economically efficient. Specifically, firms are more likely to fail to maximize profits than to fail to minimize costs.

Not all researchers are convinced about the competitive nature of real estate brokerage. Most of the disputes related to this issue have centered around three structural features of the industry: low entry barriers, limited product differentiation, and lack of price competition (see Figure 13.4). Below, we will discuss each of these features.

13.8.1.1 Entry

There are three relevant entry issues. The first is the entry of individual agents and brokers. The second is the entry of brokerage firms. The third is the entry of new business models for brokerage.

At the individual level, entry is relatively easy. The requirements for becoming a real estate agent seem to be minimal compared to other professions. A 1983 FTC Staff report on the real estate brokerage industry observed that "the nearly universal opinion is that there are no significant barriers to entry, if entry is construed as gaining a license in order to practice." The ease of entry was further confirmed in a more recent DOJ and FTC Report in 2007. In particular, for an agent, the exam to obtain a license is the only barrier, and the requirements to pass the exam are limited. Moreover, at any point in time, there

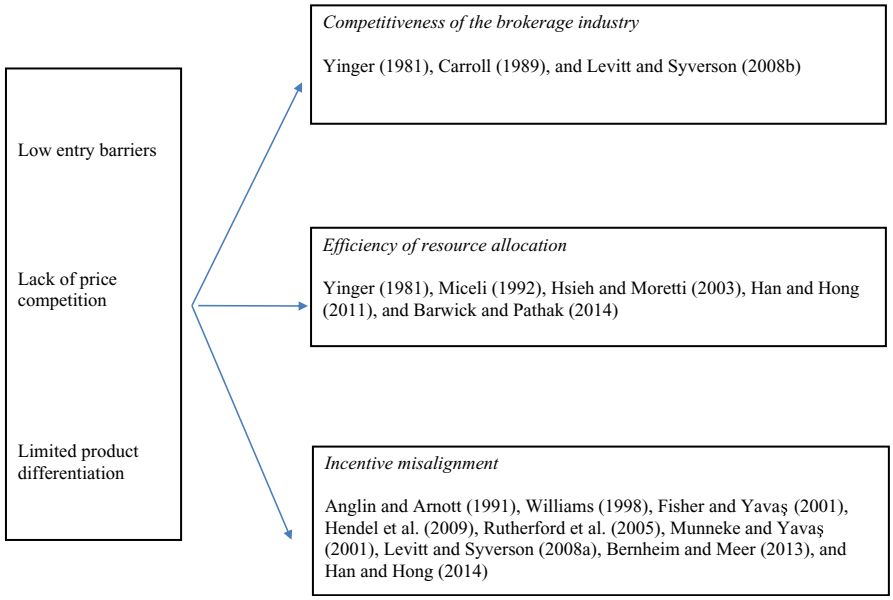

Figure 13.4 The Industrial Organization of the Real Estate Brokerage Industry. *Note: This figure lists three key characteristics of the brokerage industry and three strands of the literature that have emerged. The papers listed are examples only; see the text for a more complete review.*

are a large number of licensed but inactive agents who are presumably ready to become active when there is a profitable opportunity. According to Hsieh and Moretti (2003), about 20% of licensed agents are inactive. In most jurisdictions, broker entry requires experience as an agent and additional examinations.

Entry as a brokerage firm is more difficult. At a minimum, an entrant that wants to establish a brokerage firm must hire or become a licensed broker. Additionally, an entering brokerage firm may require an agent workforce, office space, office staff, and advertising. To establish a name recognition, a brokerage often has to pay a certain amount of franchising fees to be affiliated with a national franchise (e.g., RE/MAX) or to invest significantly to establish its own brand value.

While entry barriers at the agent and brokerage levels seem modest, entry barriers for new business models that challenge traditional full-service agency are considerably higher. This is because MLS membership is limited to licensed real estate brokers and agents that conduct business in particular manner, thereby limiting competition in price and in product variety. For example, the FTC Report (2007) discusses rules that discriminate against brokers who enter into exclusive-agency listing agreements and rules that discriminate against brokerage that takes place through virtual office websites (VOWs). The latter allow brokers to withhold their clients' listings from VOW brokers

by means of an "opt out" and limit competition from real estate brokers using innovative business models and the Internet to offer better service to their clients. These types of anticompetitive rules effectively erect entry barriers for new business models, thereby limiting price and service competition in this industry.

13.8.1.2 Product differentiation

Compared to other service industries, there is limited differentiation in the services that brokers provide. Traditional real estate brokers tend to provide a full package of services, including helping buyers perform MLS searches for homes, accompanying them on visits, helping sellers stage homes, making the house available for viewing, advertising, and setting the initial asking price. Despite the great potential for unbundling this full package of services, there is actually quite a lot of similarity in the scope of services delivered by traditional real estate agents. As discussed above, this is in part a consequence of market power associated with the MLS. In addition, some jurisdictions prevent licensed brokers from unbundling MLS listings from other services. For example, in some states, there are so-called minimum service requirements that mandate that a broker must perform a full package of services for a client. As of 2007, eight states in the United States had such law in practice (Bernheim and Meer, 2013).

There is contentious debate as to whether the services must be bundled. There is no technological reason for bundling, and standard economic arguments suggest that allowing choice from a menu of service options would have superior welfare properties. The feasibility of unbundling seems to have increased with the spread of the Internet. For instance, discount brokers will typically provide only one service, the listing of a seller's property on the MLS. They do not provide advertising or advice or any of the other elements of a full-service broker's package. The greater availability of information online presumably substitutes for these services. The rebuttal offered by brokers is that minimum service requirements ensure quality. In Section 13.9, we will review the recent literature that empirically examines the effects on selling price and time-on-market of discount brokerage and other business models.

Despite the limited degree of differentiation in service variety, real estate agents do tend to differentiate themselves by housing market segment. Almost all brokers specialize geographically. This is partly because housing markets are highly local, and as a result, the human capital that brokers accumulate over time, such as local experience, connections, and licensing requirements, is attached to the local market too. Beyond geographic specialization, some brokers further specialize by price segment, housing type, and the ethnic and social characteristics of clients. Others choose to specialize in listing or selling activities. For example, Turnbull and Dombrow (2007) showed that agents who specialize in listing properties obtain higher sales price for sellers they represent, while those who specialize in selling obtain lower prices for buyers they represent.

13.8.1.3 Price competition

An ongoing theme in research on the real estate brokerage industry is the extent to which pricing is competitive. Using the buyer-side commission rate, a number of papers show that commission rates are market-driven. For example, using 1983–1987 MLS data in Knoxville, Tennessee, Goolsby and Childs (1988) found that there is competition in the commission rate charged by real estate brokerage firms. In particular, firms are more willing to accept a lower commission rate when houses are newer or of higher value.[33] A more recent study by Schnare and Kulick (2009) uses MLS data for several metropolitan areas over the period 2000 to mid-2007. They found that buyer-side commission rates are strongly correlated with supply and demand side variables such as list price, number of transactions, number of agents, and limited-service listing agents. Their results suggest that commission rates are market-driven and competitive. To the extent that much of the negotiation of the commission rate occurs privately between home sellers and brokers and does not get reported on the local MLS, these findings may underestimate the true variations in the commission.

However, many observers believe that commission rate is still quite inflexible both across markets and over time. Owen (1977) provided evidence of this inflexibility. Later, using a nationally representative survey of home sellers and MLS data from Boston, Minneapolis, Los Angeles, and Seattle, the Federal Trade Commission's (FTC, 1983) report offers further evidence that commission rates were remarkably uniform in the late 1970s and early 1980s. Using the Consumer Expenditure Survey (CEX) from 1980 to 1998, Hsieh and Moretti (2003) showed that the commission rate continues to be fixed around 6% between 1980 and 1998. Using the statistics from the 2004 Real Trends Brokerage Performance Report, Han and Hong (2011) showed that the commission rate was around 5.1% in 2002–2003, with negligible changes in the commission rates across regions. More recently, using transaction data for the Boston area from 1998 to 2007, Barwick and Pathak (2014) found that there is little variation in commissions over time despite the increased penetration of the Internet and new technologies.

Despite the conflicting evidence about the degree of inflexibility in commission rates, it has been generally acknowledged that real estate brokerage industry has been quite successful in preserving its relatively rigid commission fees. This is particularly so when one compares the slow changes in commission rates for real estate brokers under Internet diffusion with rapid changes in commission fees in other agent-based computer service industries, such as travel agencies, stock brokers, and automobile insurance (Levitt and Syverson, 2008b).[34]

[33] Other studies along this line include Carney (1982), Sirmans and Turnbull (1997), Sirmans et al. (1991), and Miceli (1992).

[34] Examples of papers dealing with uniform commission rates include Owen (1977), Carney (1982), Crockett (1982), Wachter (1987), Goolsby and Childs (1988), Miceli (1992), Williams (1998), and Arnold (1999). Different conclusions on the uniformity of commission rates are found in Sirmans and Turnbull (1997).

This pronounced and puzzling feature of brokerage commissions, combined with the ease of entry and lack of product differentiation, has motivated three lines of research, as depicted in Figure 13.4. The research deals with the competitiveness of the real estate brokerage industry, the efficiency implications for resource allocation, and the possible misalignment between the goals of the brokers and those of their clients. The previously introduced Figure 13.3 presents a summary of selected literature regarding each of these intermediation factors. We will discuss research on each of these factors in Sections 13.8.2, 13.8.3, and 13.9, respectively.

13.8.2 The "commission puzzle" and the competitiveness of brokerage

The relatively uniform commission rate across markets and over time has led to a long-running debate about the competiveness of the real estate brokerage market. Some view the fixed commission rate as being consistent with competitive pricing. Others view it as an indicator of price discrimination supported by tacit collusion among brokers. In this section, we will present the theoretical work on both views and then discuss the related empirical evidence.

13.8.2.1 Theoretical work

Several economists argue that the fixed commission rate might be consistent with competitive pricing. Suppose that the marginal cost of selling a higher-priced unit is greater. In this case, a fixed commission could be consistent with a competitive equilibrium in which higher-priced homes receive more service and hence pay more commission fees.

In particular, some studies have investigated the competitive nature of brokerage commissions with a focus on understanding the possible gains of having a percentage commissions relative to a uniform fee across clients. For example, Schroeter (1987) demonstrated in the context of a queuing model that fixed-percentage commissions might be consistent with competition in the real estate brokerage industry. The essential prediction of his model is that, holding other things constant, brokers serving sellers of more expensive houses should serve smaller number of clients than do brokers representing sellers of less expensive ones. As a result, more expensive houses remain on the market for a shorter time than less expensive houses. Zorn and Larsen (1986) and Carroll (1989) showed that fixed-percentage commissions could emerge in a principal–agent setting. In particular, if home sellers cannot monitor real estate brokers' efforts on their behalf, fixed-percentage brokerage commissions can promote welfare by giving brokers an incentive to tailor their services to their clients' demands. Hence, there is a competitive equilibrium in which clients who value brokerage services more highly offer to pay larger commissions and consequently receive more selling effort from the broker. Knoll (1988) further showed how differences in commissions might be related to the exclusivity of the broker's contract.

Not all researchers are convinced that broker pricing is competitively determined. In fact, many economists have substantial reservations about the competitive nature of the brokerage market. Instead, they attribute the relative inflexibility of the commission rates to collusion. The idea goes back to at least Miller and Shedd (1979), whose analysis seeks to explain the fact that commission rates remained stable or even increased in the 1970s while underlying home price rose dramatically. This explanation is based on the assumption that collusive pricing would result in stable commission rates over long periods of time, and it suggests that the brokerage industry is exploiting its joint monopoly power with increasing vigor. In his classic study of the real estate brokerage industry, Yinger (1981) viewed the fixed-percentage commission scheme as a clear indicator of price discrimination that would justify government intervention in this market. He argued that "the service provided to a seller by a broker is to find a buyer and to finalize the sale. The cost of this service, is at best, only marginally related to the value of house involved, but higher-income households, who of course buy more expensive houses, are willing to pay more for this service." Yavaş (2001) presented a model where the fixed costs of brokerage (e.g., license fees; fees for local, state, and national realtor associations; continuing education expenses; and some of the office expenses) make it impossible to have competitive commission rates as the equilibrium outcome. He saw collusion as another possible explanation for the uniformity of commissions.[35]

One issue that has puzzled observers is how a collusive equilibrium, if it exists, could be maintained in the industry. Standard economic theory suggests that the difficulty of sustaining collusion grows with the number of players. In 2005, there are about two million active real estate agents and brokers, associated with 100,000 firms (White, 2006). The large number of players, combined with the ease of entry into and exit from this profession and the low concentration ratio, makes the collusion particularly difficult to implement (NAR Report, 2005).

Researchers in this literature, however, have identified at least three institutional features that have the *potential* to facilitate collusion. First, the MLS provides the identification of price-cutting activity and discourages price-cutting through the incentives it offers (Crockett, 1982). Since the access to MLS is limited to licensed real estate brokers and agents who conduct business in a particular manner, it could provide a way for the local real estate board to enforce the collusion among the members, thereby limiting price competition. Moreover, under the MLS system, when an agent submits a listing to the service, the commission available for a cooperating broker is announced. A broker that solicits listings by offering lower commissions may find himself disadvantaged since agents from other firms may prefer to bring their buyer clients to visit listings

[35] Anglin and Arnott (1999) presented a formal general equilibrium of how the commission rate is determined. Their model reflects the externalities in the market and compares the equilibrium commission rate to the socially optimal rate.

with standard commission rates. Thus, those who have hypothesized that pricing in the real estate brokerage industry is collusive have suggested that the MLS in each market eliminates the threat of price-cutting by giving information about commissions to all brokers in the market, thus making it possible for brokers to punish price-cutters (FTC, 1983; Wachter, 1987). White (2006) concluded that "the ability of the collective members of a MLS to exclude rivals—especially if those rivals are 'mavericks' who are price-cutters, with respect to commissions—can be a powerful way of enforcing a high-fee structure and thus of maintaining the collective exercise of market power."

Second, in North American residential markets, a complete real estate transaction requires coordination from both buyer-side agents and seller-side agents. Thus, it is possible for agents working on the traditional commission fee system to discipline the price-cutting agent by refusing to bring their buyers to see the latter's property (Bartlett, 1981; Crockett, 1982). This mechanism could be quite effective in enforcing the collusion, even in the absence of the MLS (White, 2006). In particular, listing agents need cooperating agents to deliver buyers. Not only can traditional commission agents collude against price-cutters by steering their buyers away from such listings, but also they can use the same punishment on other traditional commission agents who cooperate with price-cutters. The common practice of giving one broker an exclusive right to sell could further create anticompetition (Braswell and Poe, 1992).

Furthermore, some policies that local real estate boards and NAR adopted could become barriers to competition. For example, in areas where VOW policies are in place, agents could withhold a large fraction of the houses listed for sale on the MLS from flat-fee agents' VOWs. In addition, 10 states have bans on agents offering rebates to their clients (Han and Hong, 2011). These bans explicitly prevent real estate brokers from price-cutting and hence further facilitate collusion among real estate brokers.

13.8.2.2 Empirical work

Despite the extensive discussion about possible collusion among real estate brokers, there is only limited empirical evidence on this topic. The lack of the empirical work is probably due, in large part, to the following challenges. First, much of the commission data come from the MLS database, which only reports the buyer-side commissions but not the seller-side commissions. To the extent that much of the negotiation of the commissions occurs privately between home sellers and brokers, there is no direct evidence on the true variation of the commission rates. Second, discount brokerage business models typically do not report transactions through the MLS. Thus, MLS data alone are not sufficient for researchers to test whether any deviation from the standard business manner has been punished in a way that is consistent with collusion. Third, testing for competitive pricing would require measures of the broker's capacity and skills, the sellers' motivation, and the thinness of each segment of the housing market. Failure to adequately control for these factors would affect the interpretation of the

empirical findings. Finally, although a lot has been said about the possibility of collusion, no formal model of collusion in brokerage has been worked out yet. As Carroll (1989) pointed out, "in such a model, the uniform commission rate would emerge as the optimal outcome in a cooperative game. The model would explain how commission rate depends on market forces (such as home selling prices, brokers' costs, and clients' incomes) and institutional factors (such as informational asymmetries and legal restrictions)." Without such a model, it is difficult to see how a researcher might devise an identification strategy to detect collusion.

Despite the challenges, the insight of Yinger's (1981) model offers a starting point to examine competitive nature of this industry. That is, if a market is perfectly competitive, then commission rates should vary inversely with home price and positively with the brokerage cost. Suppose two houses have equal marketing costs. In this case, competitive pressures should cause brokerage fees to also be equal. More generally, fees should approximate costs in a competitive equilibrium. This will lead to a tapering of the commission rate for higher-value houses. One should expect that commission rates would vary drastically across geographic regions as housing supply and demand vary dramatically across markets. One should also expect that commission rates would change over time as the diffusion of the Internet significantly reduced the cost of providing brokerage services. Using the CEX, Hsieh and Moretti (2003) and Han and Hong (2011) found a lack of correlation between commission rate and house prices, indicating that commission rates may not be market-driven. In addition, the time variation in commission rates seems to be rather limited, suggesting that commission rates are not very responsive to the changes in technology either. On the other hand, using the MLS transaction data covering housing transactions in Baton Rouge, Louisiana, between 1985 and 1992, Sirmans and Turnbull (1997) found that the commission rates actually exhibit a surprising amount of variation in response to changes in market conditions, consistent with what a simple competitive pricing model predicts.

A first attempt to formally test collusion among real estate brokers is provided in Levitt and Syverson (2008b). They formalized the intuition about brokers' collusive behavior in a dynamic collusion model where a traditional agent chooses whether to cooperate with a discount agent in a pending transaction. If he cooperates, he will earn the commission income from the sale, but face lower expected future commissions. The model implies that a larger discount factor, greater reductions in future commissions, and a smaller loss from current sales if agents choose not to cooperate, would all lead to a higher likelihood of cooperation, making it easier to sustain collusion. Using data from three local markets, they found that houses listed using flat-fee agents have longer expected time-on-market than observably similar houses sold by full-commission agents but ultimately sell for similar prices. These results are consistent with the hypothesis that traditional agents steer clients away from flat-fee-listed homes, hence providing the first evidence for collusive behavior among real estate agents.

13.8.3 Social inefficiency

The rigid percentage commission structure in the real estate brokerage industry has profound implications not only for the competitive nature of the market but also for the efficiency of resource allocation. The central idea in the efficiency literature is that if commission rates are in fact fixed (or inflexible) and product differentiation is limited, then low entry barriers would result in socially wasteful expenditures of resources by agents in cities with higher house prices. In particular, higher commission incomes in higher-priced areas are simply dissipated through the entry of real estate agents who compete with existing agents for a fixed number of house sales. In this section, we review the theoretical and empirical work related to this argument.

13.8.3.1 Theoretical work

The idea that too many resources are devoted to brokers' search activities goes back at least to Yinger (1981). The key issue he addressed is whether the manner in which brokerage services have traditionally been provided and priced is consistent with efficiency. The main finding is that the traditional absence of price competition among brokers may have led to an inefficiently large commitment of resources to the marketing and promotion, supported by excessive rates for consumers of brokerage services.

Motivated by Yinger's insight, Crockett (1982) extended this analysis from the agent level to the brokerage firm level. He showed that a brokerage firm can increase its profits by employing more agents as more agents are likely to convert more listings into transactions. On the other hand, agents' compensation is completely contingent on their transactions. Thus, a brokerage firm is willing to hire too many agents in an effort to capture a larger share of available listings. Crockett concluded that "when price competition is forestalled, competition among firms takes nonprice routes whose ultimate effect may be to promote inefficiency in the provision of brokerage services."

One thing omitted in Crockett's analysis is free entry. Miceli (1992) went a step further by incorporating entry of brokers. This allows him to simultaneously examine the effects of nonprice competition and free entry on the allocation of resources to brokerage. By comparing the housing market equilibrium with and without brokers, he found that brokers can create a welfare gain to buyers and sellers if the commission revenue is less than the extra search costs that buyers and sellers would have to spend if they transacted on their own. However, with free entry and the absence of price competition, individual brokers compete with one another on a nonprice basis to acquire a large share of available listings. As a result, they fail to minimize the average costs of transactions.

13.8.3.2 Empirical work

The empirical literature on entry and efficiency is a recent one. In an inspiring work, Hsieh and Moretti (2003) used the 5% sample of the Census of Population and Housing

in 1980 and 1990. They showed that when the average price of land in a city increases, (1) the fraction of real estate brokers in a city increases, (2) the productivity of an average real estate agent, measured by houses sold per agent and houses sold per hour, falls, and (3) the real wage of a typical real estate agent remains unchanged. This evidence provides strong support for the idea that entry is socially excessive in the absence of price competition. A legitimate concern for this interpretation is that the higher commissions in high housing cost cities may reflect the possibility that a broker has to spend more time matching buyers and sellers in such cities. For example, expensive houses may have thinner markets, making homebuyers spend more time searching before making a decision. Therefore, the correlation between housing prices and the productivity of realtors may reflect differences in the quality of the service provided by realtors. Hsieh and Moretti addressed this concern by showing that as the average price of housing in a city increases, there is only a small increase in the amount of time a buyer spends searching for a house, and the average time a house stays on the market falls. This helps rule out the concern about differences in service quality.

Motivated by Hsieh and Moretti's work, Han and Hong (2011) and Barwick and Pathak (2014) provide quantitative evidence of the extent of inefficiency in this industry. The empirical challenge to such an exercise is that relevant data on brokerage cost is unavailable, making it difficult for researchers to quantify welfare loss associated with resource misallocation in the brokerage industry. Han and Hong (2011) and Barwick and Pathak (2014) offer a solution based on the recent methodology developments in the structural IO literature (e.g., Berry and Reiss, 2007). In particular, since the observed entry decision is an indicator of the underlying profitability, one can in principle recover the cost estimates using the information on individuals' entry decisions as well as agents. However, these two papers differ in their measures of cost inefficiency. In Han and Hong (2011), inefficiency is measured by an excessive increase in the brokerage cost in order to compete with other agents for existing listings. Such cost includes paid advertisements, writing blogs, updating websites, and informal networking with potential clients. To the extent that the benefits resulted from these brokerage activities do not offset the committed resources, this type of nonprice competition is considered inefficient. In Barwick and Pathak (2014), inefficiency is measured by the amount of income entrants could have alternatively earned had they not worked as agents. This foregone income is an inefficiency cost since agents' entry mostly dilutes the business of existing agents without increasing the total output of the brokerage industry.

More specifically, Han and Hong (2011) estimate a rational expectation equilibrium, which is represented by fixed points in entry probabilities, where agents' beliefs about other agents' entry coincide with the entry choice made by each agent. They then estimate an equilibrium model by employing a nested pseudo-likelihood algorithm (Aguirregabiria and Mira, 2002, 2007). Using the 5% sample of the 2000 Census of Population and Housing, they find strong evidence for cost inefficiency under free entry, particularly attributable to wasteful nonprice competition. They perform counterfactual

experiments to investigate the welfare impact of antirebate rules that have often been criticized for discouraging price competition. They find that rebate bans are welfare-reducing, not only because they suppress price competition from discount brokers but also because they encourage excessive entry by full-commission brokers. In an average metropolitan area with antirebate policies, removing these rebate bans would reduce real estate agents' revenues, thereby decreasing the equilibrium number of agents by 5.14% and reducing total brokerage costs by 8.87%.

Barwick and Pathak (2014) advance this literature further by specifying and estimating a richer structural model of dynamic entry and exit decisions for real estate agents. Using a comprehensive data set of agents and transactions from 1998 to 2007 in the Greater Boston area, they find that there is a strong business-stealing effect in that entry does not increase sales probabilities or reduce the time it takes for properties to sell, but rather decreases the market share of experienced agents. Motivated by these empirical patterns, they build on upon the existing dynamic discrete choice literature (e.g., Aguirregabiria and Nevo, 2010) and estimate an elegant dynamic entry and exit model. This allows them to identify the amount of income entrants could have earned had they not worked as agents based on the information about entry and exit decisions of agents combined with their observed commission revenue. The estimates imply that agents' forgone income is about 80% of their observed revenue. Using these estimates, they further compute counterfactual results from a series of interesting policy experiments. A one-half reduction in the commission rate leads to a 73% increase in the number of houses each agent sells and benefits consumers by about $2 billion. House price appreciation in the first half of the 2000s accounts for 24% of overall entry and a 31% decline in the number of houses sold by each agent. Low-cost programs that provide information about past agent performance have the potential to increase overall productivity and generate significant social savings.

As discussed earlier, the main challenge for the empirical work on social inefficiency is that costs associated with brokerage are generally not reported in any public data source. Hsieh and Moretti (2003) deal with this in their analysis by looking at declines in average broker productivity, as measured by houses sold per agent. The two structural papers take the alternative approach of backing out costs from structural entry models. This illustrates the potential usefulness of taking a structural approach to these issues. However, the heterogeneity of housing units and the heterogeneity of brokers themselves have not been addressed simultaneously in a structural context yet because of computational difficulties. With heterogeneous brokers matched to particular properties, it is possible that a fraction of the resources devoted to attracting is not pure dissipation. This calls for future research.

13.9. INCENTIVE ISSUES IN REAL ESTATE BROKERAGE

The previous section concluded with a discussion of a particular sort of inefficiency of the brokerage industry: the dissipative use of resources by brokers. This section will focus on

a different sort of inefficiency, one associated with incentive conflicts between brokers and the sellers and buyers of houses. Consider a principal–agent setting where sellers and buyers are principals and their respective brokers are agents. The essential feature of the principal–agent problem is the presence of asymmetrical information. There are two types of asymmetrical information in the real estate brokerage market: first, a client cannot observe how much effort his agent is putting into selling his property (referred to *as hidden action or moral hazard*); and second, a client does not know how knowledgeable the agent is concerning the state of the market or how skillful the agent is (referred to as *hidden type or adverse selection*). The literature has mostly focused on incentive issues resulting from the first type of information asymmetry. For example, the percentage commission structure gives the broker only a small portion of the marginal benefits from additional effort. It thus fails to align the incentives of the broker with the interests of the client. In this section, we will review both theoretical and empirical work related to incentive issues in the residential real estate brokerage industry.

13.9.1 Incentive misalignment in real estate brokerage: Theory

Broadly speaking, the real estate brokerage literature is informed by an important and substantial literature on the distortion of incentives (e.g., Gruber and Owings, 1996; Hubbard, 1998; Garmaise and Moskowitz, 2004; Mehran and Stulz, 2007). More specifically, an extensive and growing literature examines the consequence of brokers' incentive misalignment, with a particular focus on the moral hazard issues between sellers and their agents. Within this context, the central issue for the seller is to design a commission contract that aligns her own interest with the interest of her broker. A typical brokerage contract in North American markets involves a fixed commission rate and a fixed duration. Specifically, if a broker sells the property during the period of the contract, she receives a fixed percentage of the price at the time of sale; otherwise, she receives nothing. A long line of research has shown that the typical contract features serious incentive problems.

Yavaş (1996) showed that in a standard setting with one principal and one agent, a net listing contract is the only commission structure that would elicit the efficient intensity level from the agent. In Yavaş's model, with a net listing contract, the broker is the residual claimant. Any percentage commission structure where the broker receives less than 100% of the residual will fail to offer adequate incentives for optimal search effort from brokers.[36] This would lead brokers to leave their own homes on the market longer and

[36] A related idea is that contracts would be more efficient if they specified a commission rate that increases with house price. For instance, instead of paying 6% of the sales price of a $500,000 house, or $30,000 in total, a contract offering 30% of the excess of price over $400,000 would give the broker stronger incentives. However, brokerage is motivated by the lack of information of house sellers, so it is not clear how sellers might decide which sort of contract they might want to offer. In any case, such contracts do not appear to exist in the market.

sell at a higher price, compared to homes they sell for their clients (e.g., Rutherford et al., 2005; Levitt and Syverson, 2008a). The inability of percentage contracts to provide sufficient agent incentives is noted by Zorn and Larsen (1986), Anglin and Arnott (1991), Yavaş (1995), and Rutherford et al. (2004), among others.[37]

The conclusion that the percentage commission contract produces agency problem relies on an assumption that one broker works for one seller. In a one-seller-one-broker setting, the broker always allocates time between leisure and selling the asset of the single client. Since the marginal value of leisure does not depend on the commission, a percentage commission less than 100% induces the broker to consume excessive leisure and thereby to spend insufficient effort.

However, once we depart from the one-seller-one-broker assumption and allow competition among brokers, it is possible that the percentage commission scheme will no longer produce agency problems. In this section, we will first review the theoretical literature that incorporates broker competition and then review the empirical literature on a series of incentive misalignment problems caused by the current commission structure.

Two notable papers on broker competition are Williams (1998) and Fisher and Yavaş (2010). Both papers offer a model of search under a percentage commission structure and show that the compensation structure generates no agency problem. The difference between the two papers is that the results of the former paper depend crucially on the competition among agents for new listings, while the latter paper requires multiple agents to compete to sell any of the listings available on the market.

Williams (1998) introduced a model of competitive equilibrium for brokers where there is no agency problem between brokers and their current clients. The innovations in his model are the following assumptions: (1) multiple brokers, (2) possibly multiple sellers per broker, (3) costly search for both buyers and new sellers, and (4) a competitive equilibrium among brokers. His model can be summarized as follows: in each period, the representative broker chooses between labor and leisure. To each client, the broker then allocates the same time or effort and, finally, any remaining time he spends searching for new clients. For each client, the broker selects the same reservation price, independent of the number of current clients. The somewhat surprising result is that each broker spends the same time or effort selling each client's asset and selects the same reservation price as he would for his or her own assets. In other words, the standard contract with a fixed-percentage commission produces no agency problems in equilibrium between a broker and current clients. This is due to the fact that competition among brokers equates each agent's marginal productivity of effort spent with each listing to the marginal productivity of searching for new listings and the two marginal productivities are proportional to the commission rate, implying that the optimal effort spent for each client is independent of

[37] See also Larsen and Park (1989) for an empirical analysis of nonuniform commissions.

the commission rate. However, this equilibrium outcome is not efficient because time spent searching for new clients has a private value to each agent but no value to their clients or to other agents. In addition, since the average arrival rate of buyers at each house depend on the average time allocated by all brokers to other houses, this creates a further deviation between the equilibrium outcome and the Pareto optimal outcome.

Unlike Williams (1998), Fisher and Yavaş (2010) considered a setting where the percentage commission system produces no agency problem even in the absence of the competition for new listings. Their innovation is to assume multiple agents compete to sell any of the listings with the MLS. The first agent to procure a buyer receives the entire commission, while other agents obtain zero commission. Under this type of compensation rule, an agent's search intensity not only impacts the seller's payoff but also other agents' payoffs. In particular, the race among agents induces each agent to spend too much search effort to sell a given home in order to improve the probability that she is the procuring agent (as in Mortensen, 1982). On the other hand, a commission rate less than 100% would induce the broker to spend insufficient effort selling a home, as predicted by standard principal–agent analysis. In equilibrium, these two inefficiencies offset each other and result in efficient effort levels. While Yavaş and Fisher's model rationalizes the optimality of the percentage commission contract, it does not explain the observed uniform commission rates across markets and over time, because the efficient level of commission rates in their model varies with house price, size of the market, and brokerage costs, as they note.

The models in Williams (1998) and Fisher and Yavaş (2010) are important, both because competition among brokers is a constant feature of the real estate brokerage market and because the agency problem is a first-order issue that concerns buyers and sellers in this market. It is also worth noting that both models require strong assumptions. For example, both papers assume that brokers and houses are identical. With heterogeneous brokers competing for selling a particular house, such search effort is no longer purely dissipative. In addition, Fisher and Yavaş (2010) assume that the seller lists his property with the MLS system without acquiring a listing agent first. This allows them to eliminate the search by agents for new listings, which is a crucial assumption in Williams' model. While there are some signs that sellers are slowly gaining opportunities to post their listings directly on the MLS, this innovative feature is still not widely used in the current North American markets. Once we deviate from these assumptions, the standard agency problem may reemerge.

In much of the literature, broker effort generates better offers in an unspecified way. Ehrlich (2013) is an exception. He presents a model of one-sided seller search where the seller is uncertain about the state of the market, while the broker is not. When an offer arrives, the broker advises the seller on whether to take it or not. Ehrlich obtains the interesting result that a seller should always believe a broker who counsels patience, but not necessarily a broker who counsels acceptance. This captures the advisory role

of real estate brokers and the moral hazard arising from the percentage rent contract. Stacey (2013) is another exception, considering intermediation by brokers in a contracting framework. His results show how agents can improve liquidity, which is consistent with some of the empirical work reviewed here.

13.9.2 Empirical work on incentive misalignment

An extensive and growing empirical literature examines the consequence of the misalignment between goals of real estate brokers and those of home sellers. Figure 13.3, discussed in Section 13.1, illustrates many of the aspects of intermediation that we will consider in this section. The earlier work on this topic has focused on the effects of full-commission versus split-commission agreements (Munneke and Yavaş, 2001) and exclusive-agency (EA) agreement versus exclusive-right-to-sell (ERTS) agreement (Rutherford et al., 2001). More recent work has examined the effects on selling price and time-on-market of agent-owned versus client-owned properties (Rutherford et al., 2005; Levitt and Syverson, 2008a), MLS-listed versus FSBO properties (Hendel et al., 2009), and properties sold by traditional agents versus discounted agents (Levitt and Syverson, 2008b; Bernheim and Meer, 2013). One common thread running through this line of research is that the current commission arrangements have resulted in a distortion of brokers' incentives, which in turn affects how much a house is sold for and how long it takes to sell.

13.9.2.1 Broker-owned versus client-owned properties

The key incentive issue is whether brokers, as motivated by their commissions, will undertake the efficient amount of effort on behalf of their clients. While the current percentage commission scheme gives brokers an incentive to work on behalf of sellers to obtain high prices, it does not provide sufficient incentive for brokers to achieve the highest price possible, as brokers only get a small percentage of the marginal benefits from the additional effort they put in. This argument has been well established in Anglin and Arnott (1991) and Geltner et al. (1991), among others. As Levitt and Syverson (2008a) emphasized, a broker "has strong incentives to sell the house quickly, even at a substantially lower price."

This hypothesis, while intuitively appealing, can be empirically difficult to test, because brokers' effort is hard to measure. A clever approach designed by Rutherford et al. (2005) and Levitt and Syverson (2008a) is to compare brokers' performance when they sell their own houses and when they sell their clients' houses. Rutherford et al. (2005) used a sample of condominiums—a housing market segment that presumably has less degree of heterogeneity. They found that brokers received a premium of 3–7% when selling their own condominiums in comparison with similar condominiums owned by their clients. In a similar spirit, Levitt and Syverson (2008a,b) used a larger data set of single-family home sales where a portion of the sample was broker-owned to

measure for agency problems. They found that agent-owned homes sold for a price premium of about 4–5% over client-owned homes and stay on the market longer. They also used a Herfindahl index to measure the degree of heterogeneity of houses in a given city block. They found that the highest premium was in the most heterogeneous blocks.

Various other papers have taken similar approaches. Huang and Rutherford (2007) examined the effect on the sales price and the time-on-market for Realtor versus non-Realtor listed homes, where Realtor refers to members of the NAR. They found that houses sold by realtors on the MLS sell for more and sell faster than those sold by agents without that designation. Bian et al. (2013) considered a related issue, the impact of the number of houses that a broker is selling on price and liquidity. They showed that price is lower and that properties take longer to sell when there are more other listings competing for a broker's time. Jia and Pathak (2014) investigated whether sellers who pay higher commissions experience different sales outcomes. They found that a higher commission is associated with a higher likelihood of sale, a modest impact on time-on-market, and overall no effect on the sales price, consistent with high commission agents selling properties at lower prices to increase the likelihood of selling. Together, these studies provide useful evidence for the conflicts of incentives in the real estate brokerage market resulting from the percentage commission arrangement.

13.9.2.2 Broker-listed versus FSBO properties

An alternative way to examine the importance of commission incentives is to compare the sales performance of properties sold by brokers and properties sold by owners themselves. In recent years, with the diffusion of the Internet, the practice of FSBO sales ("for sale by owner"—referring to homes that are sold without using a listing broker) has gained increasing popularity. Thus, in principle, researchers can quantify the benefits of hiring a broker by examining price and liquidity effects of broker-listed versus FSBO properties. The estimated premium can then be compared with the commission fees, permitting an evaluation of the efficiency of the commission contract.

Although the task for estimating the price premium of the brokers' services relative to the FSBO sounds straightforward, in recent years, a debate has ensued over how to transform the estimated price premium into a measure of the net benefit of brokerage services. For example, NAR Report (2005) found that FSBO houses sold for a median price of $198,200 and those sold through a broker went for a median price of $230,000. The report concludes that using an agent brings sellers a significantly higher price (16%). A legitimate concern with such analysis is that it is not clear whether sellers and their houses are otherwise similar for broker-listed and FSBO homes; hence, measured differences in sales price may reflect a combination of effects.

Alternatively, one could estimate the price effects of realtor service relative to the FSBO sales, controlling for house characteristics and market conditions. However, this

strategy itself cannot convincingly control for the fact that the use of a broker is highly correlated with the characteristics of homes and homeowners. In most markets, FSBO sellers constitute a small, highly selected group with potential unusual characteristics and inclinations. According to Evans (2003), during the first quarter of 2004, 44% of all FSBO homes were never placed on the open market, as the buyer and seller knew each other in advance. In addition, FSBO sellers tend to be older and less wealthy (National Association of Realtors, 2002). Some prior studies employ sample selection corrections, but identification is driven entirely by functional form assumptions rather than exclusion restrictions. Also, some earlier studies employed data sets that were extremely small and somewhat peculiar.

Hendel et al. (2009) compared sales of MLS-listed homes sold through traditional full-service brokers to sales of homes listed on an FSBO website in Madison, Wisconsin, in 1998–2004. Their analysis is noteworthy because their data set is reasonably large, contains many FSBO transactions, and spans a 7-year period, which allows them to control for both homes and household fixed effects. Controlling for differences in-house and seller characteristics, they found that listing on the MLS does not yield a price premium relative to listing on FSBOMadison.com. However, listing on the MLS with a traditional broker does shorten the time it takes to sell a house and is more likely to ultimately result in a transaction. They also found evidence of endogenous sorting and reported that impatient sellers are more likely to list with the high commission, high service option. Note that the data set they used comes from one unique market where the FSBO sales account for about 25% of the total sales. One cannot generalize their conclusion beyond this market, as the penetration rates of the FSBO and the driving forces behind the diffusion of FSBO vary widely across markets and over time.

13.9.2.3 Traditional brokers versus discounted brokers

Between the two extremes of using a full-service broker and selling a house with no broker assistance whatsoever, there exist various intermediate options. An important example of this is the use of a discounted brokerage service, such as one that places clients' homes in the MLS for a fixed fee. Given the great degree of heterogeneity in buyer and seller demands for broker services, the practice of unbundling MLS listings with other real estate broker services can potentially improve consumer welfare. For this reason, it has gained support from both the Federal Trade Commission and the Department of Justice. This leads naturally to the question of how much value the brokerage services provide to sellers, beyond the value from being listed on the MLS. The answer to this is not obvious. On one hand, brokers offer useful knowledge and expertise. On the other hand, brokers may not represent the seller's interests given the principal–agent problem that we described earlier.

Bernheim and Meer (2013) shed light on this debate by studying Stanford Housing Listings. The houses in their sample are not listed on MLS. They compared the

performance of listings that are assisted by brokers versus FSBO sales. They found that sellers realize similar prices but sell less quickly when they elect not to hire a broker. As noted above in a different context, Levitt and Syverson (2008b) compared the performance between full-commission real estate brokers and discount brokers. They found that time-on-market is longer for houses sold with the assistance of less costly brokers, but sales prices are not significantly different. The common finding that the use of a broker has no impact on sales price seems to suggest that the incentive misalignment problem is sufficiently severe that it offsets the positive benefits brought by brokers' information advantage.

13.9.2.4 Exclusive agency versus exclusive right to sell brokers

So far, we have discussed an important agency problem that originates from the percentage commission structure. Going one step further, the literature has shown that the level of effort that brokers spend on their clients' houses also depends on the nature of the listing contract, the relationship between listing and cooperating agents, and the commission sharing arrangement between brokers and their affiliated brokerage firms. We now begin discussing these factors.

The agency relationship between the broker and the seller is formalized in the listing contract. According to Rutherford et al. (2001), the exclusive right to sell (ERTS) listing is the most common listing arrangement. With this listing, the broker receives a commission if the house sells or if a signed purchase-and-sale agreement is obtained prior to the expiration of the listing contract. This type of listing contracts is generally preferred by brokers because it offers the strongest guarantee of a commission. Another listing arrangement, exclusive agency (EA), allows the seller to avoid a commission if the seller is responsible for achieving the sale. However, similar to the ERTS listing, the listing broker receives the commission if any real estate broker achieves the sale prior to contract expiration.

Using a search-theoretic framework, Rutherford et al. (2001) showed that both contract types would yield the same price, while the EA contract would generate a greater effort level both from the broker and from the seller, hence resulting in faster sales than the ERTS contract. Using MLS data between 1994 and 1997 from Dallas–Fort Worth, Texas, they found that houses sell more quickly and at marginally lower prices under EA contracts than for ERTS contracts, consistent with what the theory suggested. Using the same data set, Rutherford et al. (2004) further looked at differences between housing market segments defined by price ranges. They found that for lower-priced houses, properties stay on the market for longer time and sell at a discount if the sale is done by brokers. On the other hand, sellers of higher-priced houses are better served by the EA contracts.

A related issue is the duration of the real estate listing contract. In North America, a typical contract specifies a fixed period of exclusivity. Anglin and Arnott (1991) noted that there is variation in the length of the period, with the most common durations falling

between 61 and 90 days. Contract duration has a number of effects. Anglin and Arnott (1991) showed that contracts that vary in duration and commission rate can be used to separate agents of different ability, with the low-ability agents more willing to sacrifice commission for longer duration. In Miceli's (1989) analysis of the optimal duration of brokerage contracts, a shorter contract may better align incentives. The idea is that agents will put forth greater effort in order to complete a sale prior to the expiration of the contract. A further issue, one not considered in the literature, is that a shorter duration may fail to give the broker proper incentives to carry out relationship-specific investments in the marketing of a particular house. See Joskow (1987) for an analysis of this in a different context. On the empirical side, Waller et al. (2010) found that time-on-market is longer when the listing contract is longer, consistent with Miceli's model.

13.9.2.5 Broker representation

When the listing broker receives the commission income from the seller, under the MLS guidelines, he then (equally) splits the commission with the cooperating broker who works on the buyer's side. This is because historically, the cooperating broker was viewed as a subagent of the seller and represented the seller's best interest. So it was logical for the seller to compensate the subagent. The obvious incentive problem with such an arrangement is that, while it gives brokers an incentive to work on behalf of the seller to obtain a higher price, it also creates perverse incentives for the broker to work on behalf of the buyer (see Lindeman, 2004).

The advent of buyer brokerage in many states has changed the legal representation in this relationship. In this case, the broker working with the buyer is no longer a subagent of the seller, but rather an agent of the buyer—referred to as a buyer broker. Using 1996 NAR data, Elder et al. (2000) found that buyer brokers appear to reduce search time but have no effect on price for buyers. Buyers with higher opportunity search costs and who are less knowledgeable about local market conditions are more likely to seek buyer brokers. Curran and Schrag (2000) also looked at the effect of buyer brokerage, showing that buyer brokerage lowers buyers' search cost and improves buyers' negotiation position in the case of high-end properties. However, as Yavaş and Colwell (1999) pointed out, as long as buyer brokers are paid a percentage of sales price, their interests are not aligned with those of the buyers.

Compared to the sellers, buyers are often considered more active in the search and matching process. This is because they can make decisions on the extensive margins, such as whether to search or not, whether to bid or not, and whether to buy or not. Recognizing the differences between buyers and sellers, Miceli (1991) proposed that sellers pay a fixed fee to a broker to list a property on the MLS and then a commission to only the broker who locates a buyer. Based on this arrangement, Yavaş and Colwell (1999) further proposed that the seller may hire a broker separately to assist with negotiations and that the buyer may separately hire a buyer broker for property showings and to assist in

negotiation. However, as Miceli et al. (2000) pointed out, such an arrangement still has not addressed the agency problems associated with buyer brokers being compensated based on the sales price.

The incentive issues present in the agency relationship are particularly severe when buyers and sellers are represented by the same brokerage office—so-called in-house transactions. In-house transactions account for about 20% of home transactions in a typical North American housing market (Han and Hong, 2014). In theory, in-house transactions could create information efficiency and reduce transaction costs, leading to an efficient match between homebuyers and sellers. However, it is also possible that agents may promote in-house transactions for their own financial interest. In particular, since matching internal listings with internal buyers helps clear inventories faster and increase the chance of securing both ends of a transaction, brokerage firms often pay a higher commission to reward agents engaged in in-house transactions. Quite naturally, these in-house transactions reflect agents' strategic efforts, creating a distortion in the home transaction process that benefits agents rather than homebuyers and sellers.

Strategic in-house transactions, if present, have at least two deleterious effects on homebuyers and sellers. First, in the search stage, real estate agents may misguide buyers (sellers) by directing their interest to internal listings (buyers), resulting in a suboptimal choice for consumers. Second, in the negotiation stage, an apparent conflict of interest arises from having the same agency represent both buyers and sellers, making it impossible for the agency to help one party without hurting the other. For these reasons, many jurisdictions have now introduced disclosure requirements for dual agency in order to help consumers avoid undisclosed and unintended dual agency relationship. The legislation requires brokerages and agents to inform both buyers and sellers about the nature of dual agency relationships in writing.

The effect of dual agency on the negotiation stage has been examined by a number of studies. For example, Gardiner et al. (2007) found that dual agency reduced the sales price and the time-on-market and that both effects were weaker after a law change in Hawaii in 1984 that required full disclosure of dual agency. Using repeated sales properties, Evans and Kolbe (2005) showed little influence by the presence of dual agent on property price. Similarly, using 10,888 transactions in Long Island, New York, in 2004–2007, Kadiyali et al. (2014) find that dual agency has an overall null effect on sales price. More recently, Johnson et al. (2014) employ MLS transaction data from Johnson County, Indiana, for the period June 1, 2000, through May 31, 2010, and find that dual agency has a null effect on sale price. By further controlling for the ownership of the property, they also find that dual agency is associated with a price premium on agent-owned properties but a price discount on government- and bank-owned properties.

Like the existing literature on the real estate brokerage, the aforementioned studies use sales price and time-on-market as key measures for assessing brokers' performance. While these measures reflect sellers' interest, they do not reflect the quality of match

between homebuyers and the houses they purchase, and hence cannot address the effect of dual agency on the search stage of the home transaction process. Han and Hong (2014) address this question by developing a structural model of in-house transactions and recover the match values that a homebuyer could obtain from internal listings and from external listings. Doing so allows them to evaluate the economic harm that the incentive misalignment brings to homebuyers. In a world where agents' interests are fully aligned with homebuyers' interests, there should be no efficiency loss associated with in-house transactions since all transactions represent the best matching outcome for buyers. On the other hand, if agents strategically interfere with the allocation of houses to individuals, buyers' benefits would be inevitably sacrificed, and a suboptimal match would be generated.

Using the home transaction data from a large North American metropolitan area, Han and Hong (2014) find that agents are more likely to promote internal listings when they are financially rewarded and that such effect is weaker after the implementation of a legislation that requires agents to disclose their dual agency relationship to their clients in writing. In particular, about 64.3% of in-house transactions are explained by efficient matching, while the remaining are likely due to agents' strategic promotion—the latter causes significant utility loss for homebuyers. They also find that the legislation has weakened the impact of agents' strategic promotion on the home matching process, which accounts for 70% of the decrease in in-house transactions after the regulatory change.

13.9.2.6 Full-commission brokers versus split-commission brokers

Once the brokers receive commissions, they split commissions with the affiliated brokerage firms. Some brokerage firms give their brokers a predetermined ratio of their commission revenue, referred to as split-commission agents. Others, such as RE/MAX, allow their brokers to retain 100% of their commission income and require a fixed amount of upfront fees instead, referred to as full-commission agents. Because a full-commission agent receives a larger commission from selling any given listing than a split-commission agent, the former would attract more listings and spend more effort on each listing. However, as the listings increase, an agent's marginal productivity declines. Using a search-theoretic framework, Munneke and Yavaş (2001) showed that in equilibrium, there will be no difference in either property price or selling time between full- and split-commission agents. Using home sales data in the Athens, Georgia, area, Munneke and Yavaş (2001) found that RE/MAX agents obtain significantly more listings than other agents. Furthermore, there is no statistically significant difference between two types of agents with respect to the time it takes to sell a listing and the sales price. Using a different data set, Allen et al. (2003) found that residential properties marketed by full-commission agents are sold more quickly and at a premium relative to properties sold by split-commission agents.

In both studies, RE/MAX agents are used to represent the full-commission agents (and hence "more productive" agents), while non-RE/MAX agents are used to represent split-commission agents (and hence "less productive agents"). Salter et al. (2007) applied the Markowitz portfolio optimization theory to determine the optimal combination of full (less risky) and split agents (more risky). They showed that firms need to retain over 10% of full-commission agents. This gives a practical explanation for the diversification of agents within a firm, and it illustrates the synergies that full and split agents create when working for the same firm. It also implies that a simple categorization of agents based on the RE/MAX affiliation may create significant measurement error and specification problems. Based upon an actual determination of each agent's specific compensation arrangement via a survey of qualifying brokers, Johnson et al. (2008) reexamined the relationship between the commission split structure and agent performance using sales data from the Montgomery, Alabama, market area. They found that full-commission agents sell their listed properties faster and at premiums compared to split-commission agents.

A limitation of this line of research is that the causal direction of the relation between commission incentives and agent performance is unclear. Rather than higher commission incentives producing better performance, it may be the case that more productive agents select to be full-commission agents (Munneke and Yavaş, 2001). For example, Zumpano et al. (2009) found that younger, male, more experienced, more past income agents tend to prefer to be full-commission agents. It would be worthwhile for researchers to analyze this important question using an equilibrium approach or select appropriate instrumental variables to address the selection issues.

13.9.2.7 Incentive issues in rental markets

We have thus far focused on intermediaries in housing purchases. There is also intermediation in the rental market, but it takes a rather different form. The vast majority of North American brokerage agreements for house sales create an exclusive relationship between the broker and seller. In leasing, there are both exclusive and nonexclusive contracts. In addition, for sales, the seller pays brokerage fees. For leasing, sometimes the landlord pays, and sometimes, the new tenant pays.

Bar-Isaac and Gavazza (2014) consider the determination of contractual form for leasing agreements using data from Manhattan. They find a pattern of contracts that is consistent with incentive issues being important in leasing brokerage. More atypical units (as defined by Haurin, 1988) are more likely to be sold under exclusive contracts. In thinner markets, it is more difficult to find well-matched tenants, and an exclusive contract gives stronger incentives to the broker. The landlord paying the fees for rent-stabilized apartments allows the charging of a high initial rent, which is important when the growth of rents is restricted.

13.9.2.8 Conclusion

If there is one theme that unifies the large body of empirical work on incentive issues, it is that researchers have focused on estimating the treatment effects of various forms of intermediation on housing transaction outcomes such as price and liquidity. However, the intermediation forms (e.g., for sale by owner vs. represented by a broker) are not randomly assigned to houses and their sellers. The variation in the data, thus, is not experimental in its nature. There is good reason to believe that sellers who adopt unusual intermediation strategies may be different in ways that impact price and marketing time. Much attention has been paid and more should be given in the future to the issue of arriving at estimates that have causal interpretations.

13.9.3 Mitigating the incentive problems

Despite the existence of a large literature on incentive misalignment in real estate, there is relatively little research on how these incentive problems might be mitigated. Williams (1998) showed that competition among agents for new listings can correct incentives, in some situations yielding first-best solutions. Fisher and Yavaş (2010) showed that a different sort of competition—the competition among agents to sell an existing listing—also may give a first-best solution. Essentially, the race among agents encourages too much effort, which counterbalances the tendency under percentage commissions to put forth too little effort.

Improvements in information will also tend to address incentive problems. Some of this is a competition effect. The Internet has allowed the creation and expansion of new business models for real estate intermediation. For instance, most of FSBO sales rely on the Internet, and they compete directly with sales intermediated by real estate brokers. As above, competition will help to correct incentive problems. Furthermore, agency problems in general stem from asymmetric information. Improvements in information technology, such as Trulia and Zillow, reduce asymmetries and thus presumably improve efficiency. There is not yet precise empirical work that examines this issue.

One very natural response by brokers themselves to the observation that there may be incentive problems is that brokers have reputations and bad behavior would be punished. Shi and Tapia (2014) considered this issue. They did this by comparing outcomes of sales between a group of sellers who leaves the area and a group who does not. The former is clearly less likely to offer referrals. They found that this group experiences faster sales and lower price.

Another approach to this issue would be to devise a contract with better incentive properties. The traditional 6% commission is a rather low-powered incentive contract. The alternative approach practiced in Vancouver of a 7% commission on the first $100,000 of house price and a lower commission on the rest makes the incentives even lower in power. Geltner et al. (1991) discussed issues of incentives and commented on the puzzling absence of stronger incentive contracts.

13.10. CONCLUSIONS

This chapter has reviewed a very large body of research that has considered how housing markets operate. This has involved reviewing the literature on housing search, bargaining, auctions, and intermediation. One conclusion that is worth emphasizing is that housing markets are illiquid. They clear through both price and various measures of liquidity, including seller and buyer time-on-market and the amount of search effort put forth by buyers and sellers.

Another clear conclusion that we can make is that housing markets are very different from other markets. Housing search, unlike labor or goods search, typically involves households acting as both buyers and sellers. This has important implications for the nature of equilibrium. Similarly, real estate brokers are different from other intermediaries in many ways. One is that they will frequently act in their own capacities as homebuyers and home sellers, something that we do not see for the intermediaries in other markets. This gives a way to learn about agency in a very fundamental way from considering brokerage. These are, of course, only a few of the ways that the specific characteristics of housing impact how housing markets operate.

For future theoretical research, there is a strong case for considering models with robust microfoundations. Most of the other issues considered in this chapter involve in some way imperfect or incomplete information, and the modeling of this is central to the theoretical analysis. Understanding, for instance, the role of the asking price requires explicit treatment of the information that it conveys to potential searchers. There is also a strong case for working with equilibrium models when possible. In models surveyed here, we have seen how equilibration has important implications for liquidity, market dynamics, and various other significant phenomena. It is worth noting that in many of these equilibrium models, a stationary framework has been the dominant theoretical paradigm. However, a nonstationary equilibrium model would be particularly useful for assessing the dynamics of the housing market, such as the overshooting phenomenon in the short run and the stickiness of asking price. Of course, any theoretical model, whether general or partial equilibrium, stationary or nonstationary, must be empirically grounded in order for the analysis to capture the unique institutions and features of the housing market.

Theory is also important for empirical work because it provides guidance for the empirical identification of a causal relationship. Housing is well known to be heterogeneous, as are households and brokers. A successful identification strategy must resolve econometric issues that arise from selection and sorting based on unobserved heterogeneity of any of these types. The chapter has identified numerous areas where identifying the effects of the market and intermediation factors illustrated in Figures 13.1–13.3 is complicated by this sort of endogeneity problem.

These problems will be difficult to resolve, but empirical progress will presumably be made easier by the availability of new data sources. Compared to traditional sources, new

data sets are sometimes much larger and are often panels. Furthermore, the new data sources sometimes contain information not only on transaction outcomes but also on the fine structure of the transaction process such as the bargaining process, bidding, and buyer search activities. The new data sources thus provide a much more comprehensive picture of the search, bargaining, and intermediation process among buyers, sellers, and brokers, allowing researchers to look at old puzzles from new perspectives and to address a variety of new issues.

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