Endogenous Realtor Intermediation and Housing Market Liquidity

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Abstract

This paper develops a housing search model to analyze the role of realtors in facilitating transactions and shaping housing market liquidity. Motivated by the recent landmark settlement between the National Association of Realtors and home sellers' associations, we contrast two market structures: a directed search equilibrium, where sellers post prices and fees, and a random search equilibrium, where matched agents bargain the terms of trade bilaterally. A comparison between the two models suggests that the settlement may have unintended consequences that lower buyers' welfare: random search features 2.5% higher prices, 17% lower sales, and 23% fewer buyers entering the market than the directed search equilibrium. Our results highlight the importance of explicitly considering realtor entry and market liquidity for a comprehensive evaluation of housing market reforms.

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Keywords: Housing market; Search and matching; Housing Market Liquidity; Directed Search; Random Search.

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1 Introduction

A well-known fact about the U.S. housing market is its remarkably high intermediation costs. While commission rates for most financial assets range from around 0.1% to 1% of the asset value, commission rates for housing market transactions are in the astonishing 5-6% range.[1] This suggests that housing equity, an important asset for the majority of American households, is a very illiquid asset (Kotova and Zhang, 2020). Although the finance literature has extensively studied the role of intermediation in financial markets, there is little theoretical work on the role of intermediation in the housing market. Moreover, the recent landmark settlement between the National Association of Realtors (NAR) and home sellers' associations, which changed the landscape of the U.S. housing market, highlights the need to understand the relationship between intermediation, realtor fees, and house prices.

To fill this gap in the literature, this paper develops a search model of the housing market in which meetings between customers and realtors, as well as meetings between realtors representing different customers are endogenous and subject to frictions. This allows us to study intermediation in the housing market and the resulting market liquidity using the tools of the over-the-counter (OTC) search literature (Lagos et al., 2017; Weill, 2020). To the best of our knowledge, this is the first paper to study endogenous intermediation in housing markets with search frictions, as well as explicitly model the relationship between intermediation, realtor fees, liquidity and prices in an equilibrium housing framework.

Our environment consists of three types of agents: households (who may want to either buy or sell a house), real estate developers (who supply new houses), and realtors (who provide intermediation services to households). Home-owning households derive utility from owning a house, which is common across all households. Separation and depreciation shocks (capturing idiosyncratic reasons to move and natural structure depreciation, respectively) lead homeowners to sell their property. On the other side of the market, households who do not own a house are looking to buy one. We make the following important assumption: households interested in selling or buying a house must be represented by a realtor to participate in the market.[2] Meetings between customers and realtors are plagued by search frictions: sellers and buyers meet realtors at rates determined by matching functions that

[1] For example, commission rates for liquid assets such as large-cap stocks, ETFs, Treasuries, Futures and FX are usually lower than 0.1%, while commission rate for less liquid mid-cap stocks and corporate bonds are usually betwee 0.1% and 1% of the asset value.

[2] Eighty eight percent of home purchases were made through a real estate agent or broker in 2024; see the 2024 Profile of Home Buyers and Sellers by NAR available here: https://www.nar.realtor/sites/default/files/2024-11/2024-profile-of-home-buyers-and-sellers-highlights-11-04-2024_2.pdf.

take the masses of agents participating in matching as inputs.

To add realism to the model, we complement the matching process with an additional step: realtors who have matched with buyers are searching for realtors who have matched with sellers to complete a transaction. The meeting rates at this stage are also determined by a matching function that takes the masses of realtors representing each side of the market as inputs. Hence, the speed at which transactions are finalized between realtors, along with the volume of these transactions (that is, the housing market liquidity) are explicit endogenous outcomes in our model. To determine house prices and realtor commissions, we employ the two most commonly used protocols in the search and matching literature. Our benchmark specification features directed search: sellers post a house price, as well as realtor fees, while buyers and realtors observe sellers' postings and direct their search to the most profitable opportunity.[3] We characterize the directed search equilibrium and show that it features three Hosios (1990)-type conditions regulating the sellers-realtors, buyers-realtors, and realtors-realtors meeting rates. Moreover, we solve the planner's problem and show that the steady state constrained efficient allocation coincides with the directed search steady state equilibrium.

Motivated by recent seismic events in the U.S. housing market, we also study a model specification with random search in which prices and fees are bargained bilaterally between the matched parties. Let us provide some context regarding the recent developments we aim to capture. On March 15, 2024, the National Association of Realtors (NRA) announced it would pay $418 million to settle litigation of several claims brought on behalf of various home sellers' associations related to realtor commissions.[4] The plaintiffs argued that the standard practices followed by real estate agents, whom NAR represents, violated antitrust laws by charging unfairly high commissions and keeping home prices artificially expensive. According to the standard practice, sellers were responsible for paying *all* realtors involved in a transaction: the buyer paid the seller the house price, then the seller would take roughly 5-6% of the price to pay their real-estate agent, who would then split that money with the buyer's agent. The plaintiffs argued that this practice did not allow sellers to negotiate realtor fees and it forced them to offer artificially high commissions to attract buyers' agents. The

[3] According to NAR's 2024 Profile of Home Buyers and Sellers, the main activity of real estate agents was to post house listings in the Multiple Listing Service (MLS), a platform used by real estate professionals to share house information. Moreover, sellers were responsible for paying all realtor fees (including the buyer's realtor commission) in most U.S. real estate transactions until recently; see the details of the March 2024 settlement between NAR and house sellers' associations that changed this practice in Footnote 4.

[4] The complete NAR announcement can be found here: https://www.nar.realtor/newsroom/nar-reaches-agreement-to-resolve-nationwide-claims-brought-by-home-sellers.

settlement aims to change this practice and "decouple" commissions from home prices by mandating that sellers' agents no longer be required to offer commissions to buyers' agents. As part of the settlement, buyers' agents are required to enter into a written agreement with prospective buyers before showing any properties. That is, the settlement mandates that buyers bargain directly with the realtors representing them to determine commissions.

Each model specification aims to capture the salient features of the U.S. housing market before and after the NAR settlement. The directed search protocol with price and fee posting corresponds to the pre-settlement regime with sellers posting prices and fees for all parties in the market. The random search protocol with each matched pair of agents bilaterally bargaining over prices and fees corresponds to the new set of rules described by the March 2024 NAR settlement. Our main numerical exercise is to use the model to quantify the potential consequences of this landmark change in the U.S. housing market. To do so, we calibrate the model parameters using the directed search model and compare its equilibrium implications with the random search protocol.

The main result of our analysis is that, contrary to pundits' expectations, the settlement will only partially fulfill its goals.[5] Even though most media commentators expect that the reform will lower house prices, our random search model features 2.5% higher prices and 17% lower house sales compared to the directed search equilibrium. Moreover, our model predicts that the settlement will have strong distributional effects: the position of sellers improves in the random search equilibrium, since sellers not only benefit from the higher house prices but also absorb a larger mass of realtors to represent them on the market. Buyers, on the other hand, lose as they have to pay more for a house and it becomes harder to find a realtor to represent them. In total, our model predicts a reduction of 23% in the mass of buyers participating in the market.

The main channel behind these results is the adverse effect of the settlement on the housing market liquidity. Intuitively, by not allowing agents to post prices and fees, the random search model leaves some gains from trade on the table and makes the housing market less dynamic. This slowdown is reflected in several features of the random search equilibrium, as it is characterized by lower realtor and buyer entry, longer time for a property to be sold, more vacant houses, and a lower homeownership rate than its directed search counterpart. These observations provide useful lessons for both policy and research purposes. The

[5] A few media accounts of the settlement can be found here: https://www.cnn.com/2024/03/15/economy/nar-realtor-commissions-settlement/index.html, https://www.cnn.com/2024/03/16/business/real-estate-commission-settlement-slash-prices/index.html, https://www.nytimes.com/2024/03/20/podcasts/the-daily/housing-market.html.

policy-relevant lesson of our analysis is that the NAR settlement may have the unintended consequence of worsening the position of buyers in the housing market. A comprehensive policy evaluation should weigh the sellers' gains with the buyers losses to determine which regime provides the highest total welfare. Finally, since the key driver of of our results is the endogenous housing market liquidity, our analysis also highlights the importance of explicitly modeling realtors' entry decisions and meeting rates. It would be impossible for models without these features to speak to the impact of the settlement to the volume and speed of housing market transactions, as the realtor behavior would be exogenous.

In terms of related literature, our contribution is similar in spirit to the work of Hugonnier et al. (2020) in the context of search models of financial OTC markets: we explicitly model the frictional meeting process between intermediaries (realtors), which yields a well-defined concept of housing market liquidity. In general, our paper contributes to the search-theoretic literature of OTC markets initiated by Duffie et al. (2005, 2007). Most closely related to ours are the papers which feature a fully decentralized asset market including Afonso and Lagos (2015), Geromichalos and Herrenbrueck (2016), Neklyudov (2019), Üslü (2019), and Hugonnier et al. (2022). All these papers feature random search and bargaining; Lester et al. (2015), Chang (2018), and Gabrovski and Kospentaris (2021) analyze OTC search models with directed search and price posting, similar to our benchmark environment.

Our paper also contributes to the large and bourgeoning literature on housing markets with search frictions that started with the seminal works of Arnott (1989) and Wheaton (1990). Papers in this literature include Albrecht et al. (2007), Albrecht et al. (2016), Anenberg (2016), Anenberg and Ringo (2024), Arefeva (2022), Arefeva et al. (2024), Burnside et al. (2016), Coulson et al. (2024), Diaz and Jerez (2013a), Gabrovski and Ortego-Marti (2019, 2021, 2022, 2024, 2025), Garriga and Hedlund (2020), Genesove and Han (2012), Guren (2018), Han and Strange (2015), Han et al. (2022), Head et al. (2014, 2016), Kotova and Zhang (2020), Kumar (2024), Moen et al. (2021), Ngai and Tenreyro (2014), Ngai and Sheedy (2020, 2024) and Smith (2020). Relative to this work, we provide a microfoundation of intermediation and apply our framework to understand the quantitative effects of the NAR settlement.

In addition, we complement recent and independent research by Buchak et al. (2024), who also study the effects of the NAR settlement. Compared to Buchak et al. (2024), our paper features a micro-founded environment that explicitly models realtors and results in endogenous intermediation. In particular, the measure of realtors, as well as the commission fees are endogenously determined both with directed and random search. Importantly, our paper features free entry of all agents, i.e. free entry of realtors, buyers and sellers. The fact that housing demand and supply, along with the participation of intermediaries, are endogenous in our model allows us to capture the general equilibrium effects of the settlement, which are crucial for a comprehensive analysis of the reform. Finally, our paper compares the directed with the random search equilibrium. These two environments provide a good representation of the pre- and post-settlement markets, respectively, and also allow us to study housing market efficiency.

The rest of the paper is organized as follows. Section 2 presents the physical environment and the benchmark directed search protocol. Section 3 characterizes the directed search equilibrium and shows that it coincides with the steady state constrained efficient allocation. In Section 4, we characterize the random search model, while in Section 5 we present the calibration strategy and our numerical results. Finally, Section 6 concludes.

2 Realtor Intermediation with Directed Search

Time is continuous and the economy is populated by three types of infinitely-lived agents: households, real estate developers, and realtors. There is a continuum of each agent type with a mass to be determined in equilibrium through entry. At any point in time households can be either homeowners, buyers, sellers, or idle. Homeowners enjoy utility from housing; buyers look for homes they would like to purchase; sellers own a home they no longer wish to live in and they would like to sell it; idle households do not own a house and have no interest in participating in the housing market at all. If the demand for houses is greater than the current supply (due to owners separating from their properties), developers decide whether to construct a house and put it for sale in the market. Realtors provide intermediation services to both buyers and sellers (who consist of households and developers). Their services are essential in the sense that market participants must hire a realtor in order to participate in the housing market. It takes time for buyers and sellers to find a realtor, as well as for realtors to find another realtor to trade on the market. We model these frictions using the tools of directed search with price posting.

Matching and trade. The market features complete price and fee transparency, as well as full commitment: sellers post and commit to prices, agent fees for the seller's realtor, and agent fees for the buyer's realtor. We denote these by p, γ^S, and γ^B respectively, and restrict them to be both positive and finite.[6] Each seller has one house they are willing to sell, which we refer to as a vacancy. Buyers and realtors observe all posted contracts and direct their search effort towards at most one such contract. We refer to the collection of all sellers posting the same contract and the buyers and realtors willing to trade under the terms of said contract as a "submarket". We denote submarkets by $\mathbf{s} \in \mathcal{S}$, where $\mathcal{S}$ is the set of all submarkets that open in equilibrium. Trading in the housing market requires the services of a realtor who can provide expert advice, help navigate regulations and the legal framework, as well as advocate for their client. Moreover, realtors specialize in either working with buyers or sellers. Thus, each submarket is comprised of two stages: at stage one buyers and sellers match with realtors and at stage two buyer-realtor pairs match with seller-realtor pairs. In both stages of the process there are search frictions, which we model through the means of matching functions.

Formally, suppose that in submarket $\mathbf{s}$ there is a mass $v(\mathbf{s})$ of sellers (where v stands for vacancies), a mass $b(\mathbf{s})$ of buyers, a mass $\rho^S(\mathbf{s})$ of realtors who specialize in working with sellers, and a mass $\rho^B(\mathbf{s})$ of realtors who specialize in working with buyers. Then, at each instant, the flow of matches between realtors and buyers/sellers is given by $M(b_0(\mathbf{s}), \rho_0^B(\mathbf{s}))$ and $M(v_0(\mathbf{s}), \rho_0^S(\mathbf{s}))$ respectively, where the subscript 0 indicates the agents have not been paired yet. The function $M(\cdot,\cdot)$ has constant returns to scale, is strictly increasing, concave, and twice continuously differentiable with respect to its two arguments. Observe that even though the matching technology dictating the flow of pairings between buyers and realtors is identical to that dictating the flow of pairings between sellers and realtors, these pairings occur at distinct parts of the submarket. That is, buyers and sellers do not congest each other when searching for realtors. Consequently, the waiting time for a buyer to match with a realtor is an exponentially distributed random variable with parameter $f(\phi^B(\mathbf{s})) = M(1, 1/\phi^B(\mathbf{s}))$, where $\phi^B(\mathbf{s}) \equiv b_0(\mathbf{s})/\rho_0^B(\mathbf{s})$ is the market tightness on the submarket for the realtor-buyer pairing stage. Symmetrically, the waiting time for a realtor to match with a buyer is an exponential random variable with a parameter $\phi^B(\mathbf{s})f(\phi^B(\mathbf{s}))$. The assumptions we have placed on the matching function imply that $f(\cdot)$ is strictly increasing and strictly concave. The waiting times for sellers and realtors looking to match with sellers are analogously given, with the only exception being the superscripts on the market tightness defined by $\phi^S(\mathbf{s}) \equiv v_0(\mathbf{s})/\rho_0^S(\mathbf{s})$.

Once a pair of buyer/seller and realtor forms, they engage in joint search on the market. This is the second stage of the submarket at which pairs look for counter-parties to buy/sell

[6] This restriction is without loss of generality and it considerably simplifies the exposition.

a house. We denote the mass of buyer-realtor pairs by $b_1(\mathbf{s})$ and the mass of seller-realtor pairs by $v_1(\mathbf{s})$. At each instant the flow of matches is given by $M^H(b_1(\mathbf{s}), v_1(\mathbf{s}))$, which has the same properties as $M(\cdot,\cdot)$. Analogously to the first stage of the submarket, the waiting times of buyers and sellers are randomly distributed with parameters $m(\theta(\mathbf{s}))$ and $\theta(\mathbf{s})m(\theta(\mathbf{s}))$, where $m(\theta(\mathbf{s})) = M^H(1, 1/\theta(\mathbf{s}))$ and $\theta(\mathbf{s}) \equiv b_1(\mathbf{s})/v_1(\mathbf{s})$. Once a match is formed, the buyer transfers $p(\mathbf{s})$ to the seller and $\gamma^B(\mathbf{s})$ to her realtor, whereas the seller transfers the house to the buyer and the fee $\gamma^S(\mathbf{s})$ to her realtor. The buyer-realtor and seller-realtor pairs are dissolved, all parties exit the submarket, and the buyer transitions to being a homeowner.

Preferences, housing tenure, and entry. All agents are risk-neutral and discount the future at rate r. Searching in a submarket is costly for all participants. We denote the costs for buyers and sellers as c^B and c^S, respectively. These include utility costs of search, as well as costs associated with preparing the vacancy to host buyer viewings (for the seller). Similarly, realtors incur flow search costs of c^{RS} and c^{RB} (depending on whether the realtor specializes in working with buyers or sellers) which are utility costs associated with advertising their services and embarking on a search for a counter-party or on a search in the second stage of the submarket on behalf of the said counter-party once paired.

Homeowners enjoy the utility of owning a house, which is ε per unit of time. This utility flow persists until the homeowner is separated from their house. This can happen in one of two instances: separation or home depreciation. With rate s the homeowner separates from the house. In that event, she transitions to being a buyer and simultaneously becomes a seller of the home. This process is meant to capture shocks to one's housing preferences stemming from household size increase, desire to physically move location to a different city, etc. Houses depreciate at rate δ. In that event, the house is destroyed and the homeowner transitions to being a buyer. This process is meant to capture the natural depreciation associated with the housing structure.

There is free entry into housing construction and development. At cost k, developers can build a new home and post it for sale on a submarket. There is also free entry of buyers: households who do not own a home can choose to participate in a submarket but they can also choose to stay idle. In that event, their utility is normalized to 0. Realtors are also free to enter the market, but they must pay a participation fee equal to $\chi\Big(\int_{\mathcal{S}}(\rho_0^S(\mathbf{s}) + \rho_0^B(\mathbf{s})d\mathbf{s})\Big)$, where $\chi(\cdot)$ is twice continuously differentiable and strictly increasing in its argument. The fee captures congestion, marketing effort, and licensing fees incurred by realtors who are competing to find a counter-party to pair with.

3 Directed Search Equilibrium

3.1 Value Functions and Equilibrium Definition

Sellers. Let $V_0(\mathbf{s})$ be the lifetime utility of a seller who posts a tuple $(p(\mathbf{s}), \gamma^S(\mathbf{s}), \gamma^B(\mathbf{s}))$ and expects market tightnesses $\phi^B(\mathbf{s})$, $\phi^S(\mathbf{s})$, and $\theta(\mathbf{s})$ in submarket $\mathbf{s}$:

$$rV_0(\mathbf{s}) = -c^S + f(\phi^S(\mathbf{s}))[V_1(\mathbf{s}) - V_0(\mathbf{s})]. \tag{1}$$

For each instant spent searching for a realtor, the seller experiences a search cost c^S. At rate $f(\phi^S(\mathbf{s}))$, she matches with a realtor and the pair transitions to the second stage. At that stage, the seller has a lifetime utility of $V_1(\mathbf{s})$, which is given by

$$rV_1(\mathbf{s}) = -c^S + \theta(\mathbf{s})m(\theta(\mathbf{s}))[p(\mathbf{s}) - \gamma^S(\mathbf{s}) - V_1(\mathbf{s})]. \tag{2}$$

Intuitively, while searching for a buyer the seller still experiences utility costs c^S. At rate $\theta(\mathbf{s})m(\theta(\mathbf{s}))$, the seller-realtor pair is matched with a buyer. In that event, the seller receives the price $p(\mathbf{s})$, pays the realtor fee $\gamma^S(\mathbf{s})$, and exits the submarket.

Buyers. The lifetime utility of a buyer who participates in a submarket $\mathbf{s}$ is denoted by $B_0(\mathbf{s})$:

$$rB_0(\mathbf{s}) = -c^B + f(\phi^B(\mathbf{s}))[B_1(\mathbf{s}) - B_0(\mathbf{s})]. \tag{3}$$

Analogously to the seller's case, the buyer incurs a utility cost c^B for each instant spent searching for a realtor. At rate $f(\phi^B(\mathbf{s}))$, she matches with a realtor and the pair transitions to the second stage of the submarket. At that stage, the buyer has a lifetime utility of $B_1(\mathbf{s})$, given by

$$rB_1(\mathbf{s}) = -c^B + m(\theta(\mathbf{s}))[H - p(\mathbf{s}) - \gamma^B(\mathbf{s})]. \tag{4}$$

While searching for a suitable house, the buyer still experiences utility costs c^B. At rate $m(\theta(\mathbf{s}))$, the buyer-realtor pair is matched with a house and a transaction occurs. The buyer transfers the price $p(\mathbf{s})$ to the seller and the fee $\gamma^B(\mathbf{s})$ to her realtor. In return, she receives the house and transitions to being a homeowner with a lifetime utility H.

Homeowners. The lifetime utility of a homeowner is given by

$$rH = \varepsilon + s[V_0 + B_0 - H] + \delta[B_0 - H], \tag{5}$$

where $V_0 \equiv \max_{\mathbf{s}\in\mathcal{S}}\{V_0(\mathbf{s})\}$, $B_0 \equiv \max_{\mathbf{s}\in\mathcal{S}}\{B_0(\mathbf{s})\}$ are the maximal attainable utilities for a seller and buyer, respectively. Moreover, we denote $V_1 \equiv V_1(\arg\max_{\mathbf{s}\in\mathcal{S}}\{V_0(\mathbf{s})\})$ and $B_1 \equiv B_1(\arg\max_{\mathbf{s}\in\mathcal{S}}\{B_0(\mathbf{s})\})$.

Realtors. Next, we turn our attention to the value functions of realtors. At the first stage of the submarket, realtors who specialize in working with sellers (buyers) incur the search cost c^{RS} (c^{RB}) until they form a match with a counter-party, which happens at rate $\phi^S(\mathbf{s})f(\phi^S(\mathbf{s}))$ $\big(\phi^S(\mathbf{s})f(\phi^S(\mathbf{s}))\big)$. Thus, the value function for realtors specializing in working with sellers and those working with buyers are:

$$rR_0^S(\mathbf{s}) = -c^{RS} + \phi^S(\mathbf{s})f(\phi^S(\mathbf{s}))[R_1^S(\mathbf{s}) - R_0^S(\mathbf{s})], \tag{6}$$

$$rR_0^B(\mathbf{s}) = -c^{RB} + \phi^B(\mathbf{s})f(\phi^B(\mathbf{s}))[R_1^B(\mathbf{s}) - R_0^B(\mathbf{s})]. \tag{7}$$

During the second stage of the submarket, realtor-buyer and realtor-seller pairs search for a counter-party to trade the house. This search is costly, hence the realtors still incur the flow search costs c^{RS} or c^{RB}, depending on which side of the market they are searching. Once a suitable trading counter-party is found, the house is transferred, the realtors receive their fees, and the realtor-buyer and realtor-seller matches are destroyed. Thus,

$$rR_1^S(\mathbf{s}) = -c^{RS} + \theta(\mathbf{s})m(\theta(\mathbf{s}))[\gamma^S(\mathbf{s}) - R_1^S(\mathbf{s}) + R_0^S(\mathbf{s})], \tag{8}$$

$$rR_1^B(\mathbf{s}) = -c^{RB} + m(\theta(\mathbf{s}))[\gamma^B(\mathbf{s}) - R_1^B(\mathbf{s}) + R_0^B(\mathbf{s})]. \tag{9}$$

Free entry and laws of motion. In our economy there is free entry of buyers, sellers, and realtors. We normalize the outside option for households who do no participate in the market to be 0; hence, in equilibrium:

$$B_0 = 0. \tag{10}$$

Entry of sellers operates through construction and development of new housing. There is no delay in home building, but it costs k to construct a new home. Thus, in equilibrium:

$$V_0 = k. \tag{11}$$

Lastly, new realtors can enter the market, but their participation is subject to congestion. Formally, we model this as an entry cost into the market $\chi\Big(\int_{\mathcal{S}}(\rho_0^S(\mathbf{s})+\rho_0^B(\mathbf{s})d\mathbf{s})\Big)$, which is a function of all realtors who offer services on the market. Free entry implies agents enter until all gains have dissipated; thus, in equilibrium:

$$R_0^S = R_0^B = \chi\Big(\int_{\mathcal{S}}(\rho_0^S(\mathbf{s})+\rho_0^B(\mathbf{s}))d\mathbf{s}\Big), \tag{12}$$

where $R_0^S \equiv \max_{\mathbf{s}\in\mathcal{S}}\{R_0^S(\mathbf{s})\}$ and $R_0^B \equiv \max_{\mathbf{s}\in\mathcal{S}}\{R_0^B(\mathbf{s})\}$. Symmetrically to the case of buyers and sellers, we denote $R_1^S \equiv R_1^S(\arg\max_{\mathbf{s}\in\mathcal{S}}\{R_0^S(\mathbf{s})\})$ and $R_1^B \equiv R_1^B(\arg\max_{\mathbf{s}\in\mathcal{S}}\{R_0^B(\mathbf{s})\})$.

At any submarket $\mathbf{s}$, the masses of agents in the first stage ($b_0(\mathbf{s})$, $v_0(\mathbf{s})$, $\rho_0^S(\mathbf{s})$, $\rho_0^S(\mathbf{s})$) are determined by free entry. However, the masses of agents at the second stage are an outcome of the matching processes. In particular,

$$\dot{b}_1(\mathbf{s}) = f(\phi^B(\mathbf{s}))b_0(\mathbf{s}) - m(\theta(\mathbf{s}))b_1(\mathbf{s}), \tag{13}$$

$$\dot{v}_1(\mathbf{s}) = f(\phi^S(\mathbf{s}))v_0(\mathbf{s}) - \theta(\mathbf{s})m(\theta(\mathbf{s}))v_1(\mathbf{s}), \tag{14}$$

$$\dot{\rho}_1^B(\mathbf{s}) = f(\phi^B(\mathbf{s}))b_0(\mathbf{s}) - m(\theta(\mathbf{s}))b_1(\mathbf{s}), \tag{15}$$

$$\dot{\rho}_1^S(\mathbf{s}) = f(\phi^S(\mathbf{s}))v_0(\mathbf{s}) - \theta(\mathbf{s})m(\theta(\mathbf{s}))v_1(\mathbf{s}). \tag{16}$$

At any instant, the flow of buyers in the second stage of the matching process is equal to the mass of buyers without a realtor times the matching rate. At the same time, the flow out of $b_1(\mathbf{s})$ equals all those buyers who are searching for housing times the house-finding rate. The intuition behind the rest of the laws of motion is analogous. Observe, however, that the laws of motion of realtors are identical to those of the counter-party they represent. This is the case because there is a one-to-one pairing between realtors and customers (buyers/sellers) and it must always be the case that $b_1(\mathbf{s}) = \rho_1^B(\mathbf{s})$ and $v_1(\mathbf{s}) = \rho_1^S(\mathbf{s})$.

The last law of motion defines how the mass of homeowners evolves over time:

$$\dot{h} = \int_{\mathcal{S}} m(\theta(\mathbf{s}))b_1(\mathbf{s})d\mathbf{s} - (s+\delta)h. \tag{17}$$

Intuitively, the flow into homeownership is the flow of all buyers matched with a house, summed across all submarkets. The flow out of homeownership is given by the mass of homeowners times the sum of the separation and destruction rates.

Out-of-equilibrium beliefs. Thus far, we have characterized the value functions on the equilibrium path only because the tightnesses $\theta(\mathbf{s})$, $\phi^B(\mathbf{s})$, and $\phi^S(\mathbf{s})$ are well-defined only for submarkets $\mathbf{s} \in \mathcal{S}$ that open in equilibrium. To extend the definition to all possible tightness levels we follow Eeckhout and Kircher (2010), Jerez (2014), and Gabrovski and Kospentaris (2021), and define beliefs in the spirit of subgame perfection. That is, sellers expect positive and finite tightnesses only if there are some agents who are willing to participate in the submarket given the posted $(p(\mathbf{s}), \gamma^S(\mathbf{s}), \gamma^B(\mathbf{s}))$. Moreover, the seller expects that given free entry, agents would queue on the market until it is no longer profitable to do so. Formally,

$$\{\theta(\mathbf{s}), \phi^S(\mathbf{s}), \phi^B(\mathbf{s})\} = \Bigg\{ \{\theta, \phi^S, \phi^B\} \in \mathbb{R}^3_+ : \\ B_0(\mathbf{s}, \theta, \phi^S, \phi^B) \geq 0, R_0^B(\mathbf{s}, \theta, \phi^S, \phi^B) \geq \chi, R_0^S(\mathbf{s}, \theta, \phi^S, \phi^B) \geq \chi \Bigg\}, \tag{18}$$

and $\theta = \phi^B = 0$, $\phi^S = \infty$ if the set is empty. If the set contains more than one element, then we assume the following procedure to resolve ties (which applies without loss of generality): sellers pick the tuple with the highest θ; if there still is a tie, then they pick the tuple with highest ϕ^B; and if there still is a tie, sellers pick the tuple with the lowest ϕ^S.

Equilibrium definition. A steady state equilibrium is a set of value functions B_0, V_0, R_0^S, R_0^B, B_1, V_1, R_1^S, R_1^B, H, a set of prices, realtor fees, and masses of agents ($p(\mathbf{s})$, $\gamma^S(\mathbf{s})$, $\gamma^B(\mathbf{s})$, $b(\mathbf{s})$, $v(\mathbf{s})$, $\rho^S(\mathbf{s})$, $\rho^b(\mathbf{s})$), $\mathbf{s} \in \mathcal{S}$, as well as tightness functions $\theta(\cdot) : \mathbb{R}_+ \to \mathbb{R}_+$, $\phi^B(\cdot) : \mathbb{R}_+ \to \mathbb{R}_+$, $\phi^S(\cdot) : \mathbb{R}_+ \to \mathbb{R}_+$ such that developers, buyers, and realtors enter the market until all gains have dissipated and their value functions equal their outside options as defined by (10), (11), and (12); sellers post prices $p(\mathbf{s})$ and realtor fees $\gamma^S(\mathbf{s})$, $\gamma^B(\mathbf{s})$ to maximize their value defined by (1) subject to (2); buyers and realtors choose the submarket $\mathbf{s}$ that maximizes their values defined by (3), (6), and (7) subject to (4), (8), and (9), respectively; the market tightness functions satisfy (18); the laws of motion (13), (14), (15), (16), and (17) hold with $\dot{b}_1(\mathbf{s}) = \dot{v}_1(\mathbf{s}) = \dot{\rho}_1^B(\mathbf{s}) = \dot{\rho}_1^S(\mathbf{s}) = \dot{h} = 0$; the accounting identities $\int_{\mathcal{S}} b_0(\mathbf{s}) d\mathbf{s} = b_0$, $\int_{\mathcal{S}} b_1(\mathbf{s}) d\mathbf{s} = b_1$, $\int_{\mathcal{S}} b(\mathbf{s}) d\mathbf{s} = b$, $\int_{\mathcal{S}} v_0(\mathbf{s}) d\mathbf{s} = v_0$, $\int_{\mathcal{S}} v_1(\mathbf{s}) d\mathbf{s} = v_1$, $\int_{\mathcal{S}} v(\mathbf{s}) d\mathbf{s} = v$, $\int_{\mathcal{S}} \rho_0^B(\mathbf{s}) d\mathbf{s} = \rho_0^B$, $\int_{\mathcal{S}} \rho_1^B(\mathbf{s}) d\mathbf{s} = \rho_1^B$, $\int_{\mathcal{S}} \rho^B(\mathbf{s}) d\mathbf{s} = \rho^B$, $\int_{\mathcal{S}} \rho_0^S(\mathbf{s}) d\mathbf{s} = \rho_0^S$, $\int_{\mathcal{S}} \rho_1^S(\mathbf{s}) d\mathbf{s} = \rho_1^S$, $\int_{\mathcal{S}} \rho^S(\mathbf{s}) d\mathbf{s} = \rho^S$, as well as the identities $b_0(\mathbf{s}) + b_1(\mathbf{s}) = b(\mathbf{s})$, $v_0(\mathbf{s}) + v_1(\mathbf{s}) = v(\mathbf{s})$, $\rho_0^B(\mathbf{s}) + \rho_1^B(\mathbf{s}) = \rho^B(\mathbf{s})$, $\rho_0^S(\mathbf{s}) + \rho_1^S(\mathbf{s}) = \rho^S(\mathbf{s})$ hold for all $\mathbf{s} \in \mathcal{S}$.

3.2 Characterizing the Equilibrium

In equilibrium, buyers and realtors enter the market until all potential gains have dissipated. Thus, $B_0(\mathbf{s}) = 0$, $R_0^S(\mathbf{s}) = R_0^B(\mathbf{s}) = \chi(\rho_0^S + \rho_0^B)$ for all submarkets $\mathbf{s}$ that open in equilibrium. Since these value functions are monotone in $p(\mathbf{s})$, $\gamma^S(\mathbf{s})$, and $\gamma^B(\mathbf{s})$, condition (18) implies that these entry relationships also hold with equality for all deviations by sellers outside of the equilibrium path. Thus, substituting the expression for $V_1(\mathbf{s})$ into that for $V_0(\mathbf{s})$ implies that the seller's problem reduces to:

$$\max_{p(\mathbf{s}),\gamma^S(\mathbf{s}),\gamma^B(\mathbf{s}),\theta(\mathbf{s}),\phi^B(\mathbf{s}),\phi^S(\mathbf{s})} V_0(\mathbf{s}) \tag{19}$$

$$\begin{aligned}
&\text{subject to} \\
V_0(\mathbf{s}) =& -\frac{c^S}{r+f(\phi^S(\mathbf{s}))} + \frac{f(\phi^S(\mathbf{s}))}{r+f(\phi^S(\mathbf{s}))}\Big[-\frac{c^S}{r+\theta(\mathbf{s})m(\theta(\mathbf{s}))} \\
&+ \frac{\theta(\mathbf{s})m(\theta(\mathbf{s}))}{r+\theta(\mathbf{s})m(\theta(\mathbf{s}))}[p(\mathbf{s})-\gamma^S(\mathbf{s})]\Big], \\
rB_0(\mathbf{s}) =& -c^B + f(\phi^B(\mathbf{s}))[B_1(\mathbf{s}) - B_0(\mathbf{s})], \\
rB_1(\mathbf{s}) =& -c^B + m(\theta(\mathbf{s}))[H - p(\mathbf{s}) - \gamma^B(\mathbf{s})], \\
rR_0^S(\mathbf{s}) =& -c^{RS} + \phi^S(\mathbf{s})f(\phi^S(\mathbf{s}))[R_1^S(\mathbf{s}) - R_0^S(\mathbf{s})], \\
rR_0^B(\mathbf{s}) =& -c^{RB} + \phi^B(\mathbf{s})f(\phi^B(\mathbf{s}))[R_1^B(\mathbf{s}) - R_0^B(\mathbf{s})], \\
rR_1^S(\mathbf{s}) =& -c^{RS} + \theta(\mathbf{s})m(\theta(\mathbf{s}))[\gamma^S(\mathbf{s}) - R_1^S(\mathbf{s}) + R_0^S(\mathbf{s})], \\
rR_1^B(\mathbf{s}) =& -c^{RB} + m(\theta(\mathbf{s}))[\gamma^B(\mathbf{s}) - R_1^B(\mathbf{s}) + R_0^B(\mathbf{s})], \\
rH =& \varepsilon + s[V_0 + B_0 - H] + \delta[B_0 - H], \\
B_0(\mathbf{s}) =& 0, \\
R_0^S(\mathbf{s}) = R_0^B(\mathbf{s}) =& \chi(\rho_0^S + \rho_0^B).
\end{aligned}$$

A variation of the above maximization problem is at the core of every directed search model. Intuitively, sellers choose prices and realtor fees optimally such that they attract tightnesses on both stages of the submarket consistent with providing just enough utility to buyers and realtors to make them indifferent between participating and not participating in the housing market. The seller solves this problem taking ρ_0^S and ρ_0^B as given. In equilibrium, her choice of tightnesses $\theta(\mathbf{s})$, $\phi^B(\mathbf{s})$, $\phi^S(\mathbf{s})$, along with those of all other sellers, pins down the sum $\rho_0^S + \rho_0^B$. The laws of motion (13) and (14) then allow us to pin down $\rho_0^S(\mathbf{s})$ and $\rho_0^B(\mathbf{s})$, which, in turn, determines $b_0(\mathbf{s})$ and $v_0(\mathbf{s})$. Having solved for the masses of buyers and the tightnesses, it is straightforward to compute the steady state solution for the mass of homeowners, h.

Let us now derive the optimality conditions for the seller's problem. It is easy to see that all sellers would chose the same prices, realtor fees, and market tightnesses in equilibrium. That is, the equilibrium is symmetric, since there is no heterogeneity among agents. This implies that there will be only one submarket in equilibrium. Thus, to ease on notation, we suppress the market indexing $\mathbf{s}$. Using the Bellman equations for realtors $(R_1^B, R_1^S, R_0^B, R_0^S)$, we can express the two fees γ^S, γ^B as functions of the market tightnesses, parameters, and the value of free entry χ:

$$\gamma^S = \frac{c^{RS}}{\theta m(\theta)} + \left[1 + \frac{r}{\theta m(\theta)}\right] \frac{c^{RS}}{\phi^S f(\phi^S)} + \left[\frac{r}{\theta m(\theta)} + \frac{r}{\phi^S f(\phi^S)} + \frac{r}{\theta m(\theta)} \frac{r}{\phi^S f(\phi^S)}\right] \chi, \tag{20}$$

$$\gamma^B = \frac{c^{RB}}{m(\theta)} + \left[1 + \frac{r}{m(\theta)}\right] \frac{c^{RB}}{\phi^B f(\phi^B)} + \left[\frac{r}{m(\theta)} + \frac{r}{\phi^B f(\phi^B)} + \frac{r}{m(\theta)} \frac{r}{\phi^B f(\phi^B)}\right] \chi. \tag{21}$$

The intuition is straightforward. Given the beliefs, realtors enter the submarket up until all potential gains have dissipated. This implies that the posted fees γ^S and γ^B are just enough to compensate realtors for the net present value of their discounted entry cost and search costs.

Similarly, we can use the Bellman equations for the buyer (B_0, B_1) to express the price as a function of tightnesses:

$$p = H - \frac{c^B}{m(\theta)} - \left[1 + \frac{r}{m(\theta)}\right] \frac{c^B}{f(\phi^B)} - \gamma^B, \tag{22}$$

where we have also imposed the free entry condition $B_0 = 0$. Similarly, buyers will enter the submarket until all potential gains have dissipated. This implies that the potential benefit of entering the market, i.e. homeownership H, is just enough to cover the house price p, the realtor fee γ^B, and net present value of search costs.

Substituting (20), (21), and (22) into the maximand (19), taking first order conditions with respect to the tightnesses, and imposing the free entry conditions $B_0 = 0$ and $V_0 = k$

yields:

$$\phi^S = \frac{1-\alpha_f}{\alpha_f}\frac{r\chi + c^{RS}}{rk + c^S}, \tag{23}$$

$$\phi^B = \frac{1-\alpha_f}{\alpha_f}\frac{r\chi + c^{RB}}{c^B}, \tag{24}$$

$$\begin{aligned}\frac{(1-\alpha)m(\theta)}{r+\theta m(\theta)}\left[\theta m(\theta)p - c^S - c^{RS} - r\chi\right] =& - c^B + (1-\alpha)m(\theta)H - c^{RB} + (1-\alpha)m(\theta)\chi \\ &- [(1-\alpha)m(\theta)+r]\left[\frac{c^B}{f(\phi^B)} + \frac{c^{RB}}{\phi^B f(\phi^B)} + \left[1 + \frac{r}{\phi^B f(\phi^B)}\chi\right]\right],\end{aligned} \tag{25}$$

where α_f and α are the elasticities of $f(\cdot)$ and $m(\cdot)$, respectively. Intuitively, the seller chooses market tightnesses ϕ^S and ϕ^B such that the contributions of each type of realtor and of the buyer into the market congestion to be proportional to their share of the surplus. To clearly see this intuition, focus on equation (23). Using the Bellman equations for R_0^S and V_0, the condition can be rewritten as:

$$(1-\alpha_f)\frac{r\chi + c^{RS}}{\phi^B f(\phi^B)} = \alpha_f\frac{rk + c^S}{f(\phi^B)} \Leftrightarrow (1-\alpha_f)(R_1^S - R_0^S) = \alpha_f(V_1 - V_0). \tag{26}$$

Since the surpluses of the realtor and seller are respectively $R_1^S - R_0^S$ and $V_1 - V_0$, it is evident that the seller receives a fraction $1-\alpha_f$ of the surplus whereas the realtor receives the fraction α_f. This condition is analogous to the usual Hosios (1990) condition, which is commonly found in the equilibrium of several directed search models.

The choice for the housing market tightness θ follows a similar logic. To see that, substitute in the expressions for the Bellman equations into equation (25) to derive:

$$\alpha[H - B_1 - p - R_1^B + \chi] = (1-\alpha)[p - V_1 - R_1^S + \chi]. \tag{27}$$

Since $p - V_1 - R_1^S + \chi$ is the surplus of the seller-realtor pair from the transaction and $H - B_1 - p - R_1^B + \chi$ is the surplus of the buyer-realtor pair from the transaction, then it follows that the seller-realtor pair receives a fraction α of the surplus and the buyer-realtor pair a fraction $1-\alpha$. This is again in line with the usual Hosios condition. In fact, the equilibrium condition for the market tightness makes this even more evident. Combine the Bellman equations for V_1 and R_1^S, as well as those for B_1 and R_1^B, and substitute in equation

(27) to get:

$$
\begin{aligned}
r[V_1 + R_1^S] &= -c^S - c^{RS} + \alpha\theta m(\theta)[H - B_1 - V_1 - R_1^B - R_1^S + 2\chi], \\
r[B_1 + R_1^B] &= -c^B - c^{RB} + (1-\alpha)m(\theta)[H - B_1 - V_1 - R_1^B - R_1^S + 2\chi].
\end{aligned}
$$

Combining these two yields an expression of the surplus from trade in the realtor market:

$$
H - B_1 - V_1 - R_1^B - R_1^S + 2\chi = \frac{rH + 2r\chi + c^S + c^B + c^{RS} + c^{RB}}{r + \alpha\theta m(\theta) + (1-\alpha)m(\theta)}. \tag{28}
$$

Use the above along with (26) and the Bellman for V_0 from (19) to get an equation for the market tightness equivalent to the housing entry condition from Gabrovski and Ortego-Marti (2019) in our setting:

$$
\frac{r}{\theta m(\theta)}\left[\frac{rk + c^S}{(1-\alpha_f)f(\phi^S)} + \chi + k\right] + \frac{c^S + c^{RS}}{\theta m(\theta)} = \alpha\frac{rH + 2r\chi + c^S + c^B + c^{RS} + c^{RB}}{r + \alpha\theta m(\theta) + (1-\alpha)m(\theta)}. \tag{29}
$$

Intuitively, sellers will enter the market until all potential gains from trade have dissipated. Thus, the potential gain from participating in the market, a fraction α of the surplus (captured on the right hand side of the equation) is equated to the expected costs from search and construction (captured on the left hand side of the equation).

Next, to complete the characterization of the equilibrium, we need to find an expression for H and to solve for the steady state masses of agents. Using the Bellman equation for H and free entry, it follows that:

$$
H = \frac{\varepsilon + sk}{r + s + \delta}.
$$

Next, evaluating the laws of motion (13) and (14) at steady state yields:

$$
\frac{\rho_0^S}{\rho_0^B} = \frac{\phi^B f(\phi^B)}{\phi^S f(\phi^S)}. \tag{30}
$$

The last two equations above, together with equations (23), (24), (29), a functional form for χ, and the laws of motion evaluated at steady state solve for the masses of agents $(\rho_0^S, \rho_0^B, b_0, v_0, b_1, v_1, h)$.

3.3 Constrained Efficiency

Given that all three market tightnesses are determined according to the Hosios condition, one would expect the equilibrium of the benchmark model to be constrained efficient. Indeed this is the case with most directed search models. In this section we introduce the planner's solution and establish that the decentralized equilibrium is not constrained efficient in general but only in the steady state. The reason is that there is free entry of all three types of agents. Given this, there is congestion in χ that sellers take as given when they make their posting decisions. The planner, on the other hand, acknowledges this fact and sets the optimal size of the market accordingly. Thus, the economy is not constrained efficient in general. However, at steady state there is no entry into the realtor sector, and, as a result, there is no congestion. Hence, directed search achieves the constrained efficient allocation at steady state.

Let us first introduce the planner's problem. It is easy to see that the planner will find it optimal to allocate all agents to the same submarket because of symmetry and constant returns to scale in matching. The social welfare function is given by:

$$\int_0^\infty e^{-rt}\left[h\varepsilon - c^B(b_1+b_0) - c^S(v_1+v_0) - c^{RB}(\rho_0^B+b_1) - c^{RS}(\rho_0^S+v_1) - kc - \chi(\rho_e^S+\rho_e^B)\right]dt, \tag{31}$$

where c is construction and ρ_e^B and ρ_e^S denote realtor entry into the market. Intuitively, the planner chooses an allocation that maximizes the total utility from homeownership $h\varepsilon$ net of search costs and entry costs, subject to the laws of motions for buyers, sellers, and realtors. Using our notation for entry and construction, these can be expressed as:

$$\begin{aligned}
\dot{b}_1 &= f(\phi^B)b_0 - m(\theta)b_0,\\
\dot{v}_1 &= f(\phi^S)v_0 - m(\theta)v_0,\\
\dot{v}_0 &= c + sh - f(\phi^S)v_0,\\
\dot{\rho}_0^B &= \rho_e^B + b_1 m(\theta) - \rho_0^B\phi^B f(\phi^B),\\
\dot{\rho}_0^S &= \rho_e^S + v_1\theta m(\theta) - \rho_0^S\phi^S f(\phi^S),\\
\dot{h} &= \theta m(\theta)v_1 - (\delta+s)h.
\end{aligned}$$

Thus, the planner's problem is to maximize (31) subject to the laws of motion and the definitions of the tightnesses, $(\theta = b_1/v_1, \phi^S = v_0/\rho_0^S, \phi^B = b_0/\rho_0^B)$.

Let λ_x be the co-state associated with the law of motion of any variable x. Moreover, we denote by $\lambda_\theta, \lambda_{\phi^S}, \lambda_{\phi^B}$ the co-states associated with the definitions of the market tightnesses. Then, the Hamiltonian is given by:

$$H = e^{-rt}\Bigg\{ h\varepsilon - c^B(b_1+b_0) - c^S(v_1+v_0) - c^{RB}(\rho_0^B + b_1) - c^{RS}(\rho_0^S + v_1) - kc - \chi(\rho_e^S + \rho_e^B)$$

$$+\lambda_{b_1}\left[f(\phi^B)b_0 - m(\theta)b_1\right] + \lambda_{v_1}\left[f(\phi^S)v_0 - \theta m(\theta)v_1\right] + \lambda_h\left[\theta m(\theta)v_1 - (\delta+s)h\right]$$

$$+\lambda_{v_0}\left[c + sh - f(\phi^S)v_0\right] + \lambda_{\rho_0^B}\left[\rho_e^B + b_1 m(\theta) - \phi^B f(\phi^B)\rho_0^B\right]$$

$$+\lambda_{\rho_0^S}\left[\rho_e^S + v_1\theta m(\theta) - \phi^S f(\phi^S)\rho_0^S\right] + \lambda_\theta\left[b_1 - \theta v_1\right] + \lambda_{\phi^B}\left[b_0 - \rho_0^B\phi^B\right] + \lambda_{\phi^S}\left[v_0 - \rho_0^S\phi^S\right]\Bigg\}.$$

The first order conditions read:

$$\begin{aligned}
[\theta]: &\quad \lambda_\theta = \alpha m(\theta)[\lambda_{b_1} - \lambda_{\rho_0^B}] + (1-\alpha)m(\theta)[\lambda_h - \lambda_{v_1} + \lambda_{\rho_0^S}],\\
[\phi^S]: &\quad \lambda_{\phi^S} = -(1-\alpha_f)f(\phi^S)\lambda_{\rho_0^S} - \alpha_f f(\phi^S)[\lambda_{v_1} - \lambda_{v_0}],\\
[\phi^B]: &\quad \lambda_{\phi^B} = -(1-\alpha_f)f(\phi^S)\lambda_{\rho_0^B} - \alpha_f f(\phi^B)\lambda_{b_1},\\
[c]: &\quad k = \lambda_{v_0},\\
[\rho_e^S]: &\quad \chi = \lambda_{\rho_0^S},\\
[\rho_e^B]: &\quad \chi = \lambda_{\rho_0^B},\\
[b_0]: &\quad \lambda_{b_1} = \frac{c^B}{f(\phi^B)} - \frac{\lambda_{\phi^B}}{f(\phi_B)},\\
[v_0]: &\quad -\dot{\lambda}_{v_0} + r\lambda_{v_0} = -c^S + \lambda_{v_1}f(\phi^S) - \lambda_{v_0}f(\phi^S) + \lambda_{\phi^S},\\
[\rho_0^S]: &\quad -\dot{\lambda}_{\rho_0^S} + r\lambda_{\rho_0^S} = -c^{RS} - \chi'(\rho_e^S + \rho_e^B) - \lambda_{\rho_0^S}\phi^S f(\phi^S) - \lambda_{\phi^S}\phi^S,\\
[\rho_0^B]: &\quad -\dot{\lambda}_{\rho_0^B} + r\lambda_{\rho_0^B} = -c^{RB} - \chi'(\rho_e^S + \rho_e^B) - \lambda_{\rho_0^B}\phi^B f(\phi^B) - \lambda_{\phi^B}\phi^B,\\
[v_1]: &\quad -\dot{\lambda}_{v_1} + r\lambda_{v_1} = -c^S - c^{RS} + \theta m(\theta)[\lambda_h - \lambda_{v_1}] + \lambda_{\rho_0^S}\theta m(\theta) - \lambda_\theta,\\
[b_1]: &\quad -\dot{\lambda}_{b_1} + r\lambda_{b_1} = -c^B - c^{RB} - m(\theta)[\lambda_{b_1} - \lambda_{\rho_0^B}] + \lambda_\theta,\\
[h]: &\quad -\dot{\lambda}_h + r\lambda_h = \varepsilon - (\delta+s)\lambda_h + s\lambda_{v_0}.
\end{aligned}$$

Cumbersome but straightforward manipulations of the above conditions yield the following system of equations that solve for the constrained efficient tightnesses:

$$\phi^S = \frac{1-\alpha_f}{\alpha_f} \frac{\chi'(\rho_e^S + \rho_e^B) + r\chi + c^{RS}}{rk + c^S}, \tag{32}$$

$$\phi^B = \frac{1-\alpha_f}{\alpha_f} \frac{\chi'(\rho_e^S + \rho_e^B) + r\chi + c^{RB}}{c^B}, \tag{33}$$

$$\frac{r}{\theta m(\theta)} \left[\frac{rk + c^S}{(1-\alpha_f) f(\phi^S)} + \chi + k \right] + \frac{c^S + c^{RS}}{\theta m(\theta)} = \alpha \frac{r \frac{\varepsilon + sk}{r+s+\delta} + 2r\chi + c^S + c^B + c^{RS} + c^{RB}}{r + \alpha\theta m(\theta) + (1-\alpha) m(\theta)}. \tag{34}$$

We see that the equation for the tightness in the realtor stage of submarket, θ, is the same as in the decentralized equilibrium. The expressions for ϕ^S and ϕ^B are very similar to their decentralized counterparts but with one slight difference, the presence of the $\chi'(\rho_e^S + \rho_e^B)$ term. Intuitively, additional entry of realtors increases the marginal cost of entry for all other realtors and the planner takes this congestion into account. Agents in the decentralized equilibrium, however, ignore this congestion effect.

Combining the laws of motion reveals that at steady state $\rho_e^B = \rho_e^S = 0$, i.e. there is no entry into the realtor sector. This is the case because, once they enter, realtors stay in the market forever, offering their services to prospective buyers and sellers. Thus, there is no congestion from entry in steady state, which eliminates the $\chi'(\rho_e^S + \rho_e^B)$ term from the planner's solution, making it identical to the decentralized one. Lastly, the laws of motion for the planner are the same as those in the decentralized economy. Thus, given that the tightnesses at steady state are the same, so are the masses of agents $(\rho_0^S, \rho_0^B, b_0, v_0, b_1, v_1)$, which proves constrained efficiency.

4 Realtor Intermediation with Random Search

In Section 3, we derived the housing market equilibrium when sellers post prices and realtor fees and showed that the steady state allocation is constrained efficient. In this section, we explore the equilibrium properties of an alternative price setting mechanism, motivated by the recent housing market reforms in the U.S. following the settlement of an antitrust lawsuit against the National Association of Realtors (NAR) by various home sellers associations. Specifically, the plaintiffs alleged that the rules mandated by NAR (that used to prescribe that sellers have to pay the buyers' realtors) together with the fact that realtors direct the search of the buyers they represent according to posted commissions, had several adverse consequences for sellers: (i) sellers incur the total cost of commissions; (ii) commissions are artificially inflated, which leads to artificially inflated house prices and less transactions; and (iii) commissions posted by sellers incentivizes "steering", a practice where the realtor representing a buyer will not show or discourage their clients from properties that offer lower commissions.[7] As part of the settlement of the lawsuit, the NAR agreed to the following reform of the rules of its Multiple Listing Service (MLS) platform (the portal many realtors subscribe to in order to share and receive information about for-sale houses): (i) sellers cannot post, nor pay a commission to the buyers' agents; (ii) offering or accepting compensation to buyers' realtors will no longer be a condition for MLS membership and participation; and (iii) realtors and buyers must negotiate a commission and enter a written agreement before touring homes.[8] Through the lens of our search and matching framework, we interpret this settlement between NAR and sellers' associations as a move from price and fee posting to a market in which prices and fees have to be bargained. Thus, we explore the market equilibrium under random search and bargaining: all fees and prices are bargained bilaterally.

4.1 Environment

In this section, we present our model with random search and bargaining. That is, the economy is the same as in the benchmark version, except sellers cannot post prices or realtor fees. Thus, the Bellman equations are the same as in Section 3. Motivated by the recent settlement between NAR and sellers' associations, we assume that prices and fees are bargained using Nash bargaining:

$$\begin{aligned}
\gamma^S &= \arg\max_{\gamma^S} \left[V_1 - V_0\right]^{\eta} \left[R_1^S - R_0^S\right]^{1-\eta}, \\
\gamma^B &= \arg\max_{\gamma^B} \left[B_1 - B_0\right]^{\eta} \left[R_1^B - R_0^B\right]^{1-\eta}, \\
p &= \arg\max_{p} \left[H - B_1 - p - \gamma^B\right]^{\beta} \left[p - V_1 - \gamma^S\right]^{1-\beta}.
\end{aligned}$$

We assume that parties have different bargaining powers in different stages of the process: η is the bargaining power of buyers and sellers, $1-\eta$ is the bargaining power of realtors when bargaining with buyers and sellers, β is the bargaining power of realtors representing

[7]See, for example, the case summary made available on the website of Cohen Milstein, a co-lead class counsel in Moehrl, et al. v. National Association of Realtors, et al., Case No. 19-cv-01610 (N.D. Ill.) and Gibson, et al. v. National Association of Realtors, et al., Case No. 4:23-cv-00788 (W.D. Mo.) available at https://www.cohenmilstein.com/case-study/moehrl-v-national-association-realtors-et-al/.

[8]See https://www.cohenmilstein.com/case-study/moehrl-v-national-association-realtors-et-al/ and https://www.nar.realtor/the-facts/what-the-nar-settlement-means-for-home-buyers-and-sellers.

buyers, and $1-\beta$ is the bargaining power of realtors representing sellers. Moreover, we assume sequential bargaining following the existing literature (Gabrovski and Ortego-Marti, 2021, 2025). That is, the buyer and seller take the negotiated commissions as given, but the commissions are functions of the house price.

4.2 Equilibrium

Bargaining implies that the realtors receive a fraction $1-\eta$ of the surplus when they match either with a buyer or a seller. This is similar to the case with directed search, except the elasticity of the matching function is replaced with the bargaining power. Thus, using free entry, it is straightforward to show that in equilibrium:

$$\phi^S = \frac{\eta}{1-\eta}\frac{r\chi + c^{RS}}{rk + c^S}, \tag{35}$$

$$\phi^B = \frac{\eta}{1-\eta}\frac{r\chi + c^{RB}}{c^B}. \tag{36}$$

Next, manipulating the Bellman equations for the realtors $(R_1^B, R_1^S, R_0^B, R_0^S)$ yields expressions for realtor fees that are identical to those from the directed search equilibrium:

$$\gamma^S = \frac{c^{RS}}{\theta m(\theta)} + \left[1 + \frac{r}{\theta m(\theta)}\right]\frac{c^{RS}}{\phi^S f(\phi^S)} + \left[\frac{r}{\theta m(\theta)} + \frac{r}{\phi^S f(\phi^S)} + \frac{r}{\theta m(\theta)}\frac{r}{\phi^S f(\phi^S)}\right]\chi,$$

$$\gamma^B = \frac{c^{RB}}{m(\theta)} + \left[1 + \frac{r}{m(\theta)}\right]\frac{c^{RB}}{\phi^B f(\phi^B)} + \left[\frac{r}{m(\theta)} + \frac{r}{\phi^B f(\phi^B)} + \frac{r}{m(\theta)}\frac{r}{\phi^B f(\phi^B)}\right]\chi.$$

Intuitively, free entry pushes realtors to enter the market until all potential gains have dissipated. At that point, the negotiated fees are just enough to offset the annualized search and entry costs. This conclusion has important implications for understanding how the market structure impacts the negotiated realtor fees. The only channels through which they are impacted are indirect general equilibrium effects that change the levels of the market tightnesses, as well as entry decisions. In particular, buyers can negotiate lower fees only if the time-to-buy is lower or realtors match quicker with buyers.

It will be useful for our exposition to also express the fees as functions of the price. Using the Nash bargaining solution and substituting the values of V_1, B_1, R_1^S, and R_1^B from (2), (4), (8), and (9) yields:

$$\gamma^S = (1-\eta)\left[p - \frac{c^S}{\theta m(\theta)} + \frac{r+\theta m(\theta)}{\theta m(\theta)}k\right] - \eta\left[\chi - \frac{c^{RS}}{\theta m(\theta)}\right], \tag{37}$$

$$\gamma^B = (1-\eta)\left[H - \frac{c^B}{m(\theta)} - p\right] - \eta\left[\chi - \frac{c^{RB}}{m(\theta)}\right]. \tag{38}$$

Intuitively the fees are a weighted average of the surplus to the seller/buyer and the realtor. Importantly, a unit increase in the price increases/decreases the fee for the seller/buyer's agent by $1-\eta$ units. That is, part of the benefit/burden of a higher price is shared with the realtor.

Next, we turn to how prices are formed. Given the solution for the fees, Nash bargaining implies that:

$$(1-\beta)\left[H - B_1 - p - \gamma^B\right] = \beta\left[p - V_1 - \gamma^S\right]. \tag{39}$$

The above equation is the random search model analog of (27) from the benchmark model. As was the case with the customers' market tightnesses, the bargaining power replaces the elasticity of the matching rates. However, there is an additional important difference: the surpluses which the price splits are different. In the benchmark directed search model, the seller acknowledges that there are four parties engaged in the trade of the house: the buyer, the seller, and two realtors. Thus, the surplus takes into account the outcomes of realtors too. With random search and bargaining, on the other hand, the surplus only takes into account the outcomes for the buyer and the seller, as these are the two contracting parties. The outcomes for the realtors are only taken into account indirectly through the fees γ^S and γ^B.

Substituting in for the value functions implies that the equilibrium house price is:

$$p = (1-\beta)\left[\frac{\varepsilon + sk}{r+s+\delta} - \frac{c^B}{f(\phi^B)} - \gamma^B\right] + \beta\left[\frac{[r+f(\phi^S)]k + c^S}{f(\phi^S)} + \gamma^S\right]. \tag{40}$$

We can then use this expression for the price and follow an analogous procedure to that in

Section 3 to derive an expression for the surplus:

$$H - B_1 - V_1 - \gamma^B - \gamma^S = \frac{rH + 2r\chi + c^S + c^B + c^{RS} + c^{RB}}{r + (1-\beta)\theta m(\theta) + \beta m(\theta)} - \frac{\left[1 + \frac{r}{m(\theta)}\right]\left[1 + \frac{r}{\phi^B f(\phi^B)}\right](c^{RB} + r\chi) + \left[1 + \frac{r}{\theta m(\theta)}\right]\left[1 + \frac{r}{\phi^S f(\phi^S)}\right](c^{RS} + r\chi)}{r + (1-\beta)\theta m(\theta) + \beta m(\theta)}. \tag{41}$$

We can clearly see the impact of random search and bargaining on the surplus in the preceding equation when compared with the corresponding equation (28) of the directed search model. The second line represents the reduction in the surplus from not allowing the seller to post a contract which includes realtor fees. This affects the determination of the market tightness in the realtor search stage of the market.

Using the Bellmans for V_0 and V_1 yields the housing entry condition:

$$\frac{r}{\theta m(\theta)}\left[\frac{rk + c^S}{f(\phi^S)} + k\right] + \frac{c^S}{\theta m(\theta)} = (1-\beta)\frac{rH + 2r\chi + c^S + c^B + c^{RS} + c^{RB}}{r + (1-\beta)\theta m(\theta) + \beta m(\theta)} - (1-\beta)\frac{\left[1 + \frac{r}{m(\theta)}\right]\left[1 + \frac{r}{\phi^B f(\phi^B)}\right](c^{RB} + r\chi) + \left[1 + \frac{r}{\theta m(\theta)}\right]\left[1 + \frac{r}{\phi^S f(\phi^S)}\right](c^{RS} + r\chi)}{r + (1-\beta)\theta m(\theta) + \beta m(\theta)}. \tag{42}$$

Compared to equation (29) of the benchmark economy, the surplus is different but so is the left-hand side which only looks at the seller's costs of entry and operation. This is again due to the fact that the seller cannot post a contract specifying realtor commissions.

Lastly, to close the model, we use equation (30) since the laws of motion are identical to those in the benchmark economy.

5 Numerical Analysis

In this section, we study the quantitative properties of our housing market model under both directed search with price and fee posting, as well as random search with bargaining. As explained above, we view the recent settlement between the NAR and homesellers associations as a move from directed to random search through the lens of the model. Hence, comparing the steady state equilbria of these two search protocols will quantify the model predictions regarding this landmark change. We are particularly interested in the behavior of realtor fees, prices, and trading time and volume in the market. The analysis proceeds in two steps: first, we calibrate the benchmark model with directed search to the U.S. economy. Second,

Parameter	Description	Value
r	Discount Rate	0.0012
ε	Homeownership Utility	1
δ	House Depreciation Rate	0.004
s	House Separation Rate	0.024
α	Housing Market Matching Elasticity	0.16

Table 1: Externally Calibrated Parameters

we compare the directed with the random search model and study a series of comparative statics exercises in the two models.

5.1 Calibration

We calibrate the benchmark directed search model at quarterly frequency. Several parameters are set outside the model. The discount rate is set to $r = 0.012$ in order to match a 0.953 annual discount factor. The utility of homeownership, ε, is normalized to 1 and we set the house depreciation rate $\delta = 0.004$ in order to match a 1.6% annual depreciation rate (Van Nieuwerburgh and Weill, 2010). Following Diaz and Jerez (2013b), we target an average housing tenure of 9 years, which yields the separation $s = 0.024$. With regards to the functional forms of the matching functions in the housing and realtor markets, we follow Gabrovski and Ortego-Marti (2019, 2021, 2025), and Anenberg and Ringo (2024), among others, and assume Cobb-Douglas speicifications: $m(\theta) = \mu\theta^{-\alpha}$, $f(\phi^B) = \mu^B \left(\phi^B\right)^{\alpha_f}$, and $f(\phi^S) = \mu^S \left(\phi^S\right)^{\alpha_f}$. Consistent with the evidence in Genesove and Han (2012) and Grindaker et al. (2021), we set the elastictiy of the matching function in the housing market to $\alpha = 0.16$. The values of all externally set parameters are summarized in Table 1.

This leaves us with ten remaining parameters which are calibrated to make the model match various empirical targets. First, we need to pin down the parameters of the two matching functions: the matching efficiency coefficients μ, μ^B, and μ^S, as well as the elasticity α_f. Following Gabrovski and Ortego-Marti (2019) and Ngai and Sheedy (2020), we set the average time-to-sell to 2 quarters. Moreover, the average time-to-buy is set equal to the average time-to-sell, as in Gabrovski and Ortego-Marti (2019, 2021, 2025). Next, we set $f(\phi^S) = 2$ and $f(\phi^B) = 3$ as the two additional moments we need. These values imply that, on average, it takes about a month and a half for a seller to find the right realtor and list the house for sale, whereas it takes a buyer about a month to find a realtor and secure a mortgage pre-approval. Second, we use cost information to pin down the housing cost parameter k. Gabrovski and Ortego-Marti (2025) estimate that the total costs to create a vacancy for construction and development firms (the cost of construction, development, finding credit, and the interest payments for that credit) are about 96% of the price of a newly constructed house. This number is also consistent with the 93% recovered in the calibrations of Gabrovski and Ortego-Marti (2019, 2021). Thus, we set $k = 93\%$ of the house price. Third, we use several moments to inform the search cost parameters c^B, c^S, c^{RB}, and c^{RS}. Following Barwick et al. (2017), the realtor fees γ^S and γ^B are set to 2.20% of the price.[9] This number is also close to that recovered by Gabrovski and Ortego-Marti (2019) in their calibration. Next, we use estimates from Han and Hong (2011) who estimate that the average annual revenue for realtors is $42,632 and the average house price is $147,472. Taking their ratio, we set total realtor revenue to 28.9% of the house price. Moreover, Han and Hong (2011) estimate the annual realtor costs to be $13,951 and that realtors make on average 12.43 transactions per year. Thus, we set the realtor costs per transaction to 0.76% of the house price. Finally, these moments allow us to pin down all model parameters, except for those relating to the $\chi(\cdot)$ congestion function. We assume a constant elasticity congestion function, $\chi = \frac{1}{\epsilon}(\rho_0^S + \rho_0^B)^\epsilon$, with $\epsilon = 2$.

The tractability of the model allows to exactly pin down the parameters that make the model consistent with the empirical targets of our calibration. All internally calibrated parameter values are collected in Table 2. We use the calibrated model as a laboratory for various quantitative exercises in the following section.

5.2 Numerical Results

In this section, we present the results of the main numerical exercise of the paper, namely the comparison between the directed and random search steady states. This comparison aims to capture the regime change observed in the US housing market after the recent settlement between the NAR and homesellers associations. Table 3 summarizes all equilibrium variables of interest in the steady states of the two models.

The comparison between the two models suggests several consequences of the recent housing market reform. To begin with, the random search model features 2.5% higher prices

[9] It should be noted that Barwick et al. (2017) report fees to be 2.25% of the house price. However, in the data transaction prices include the buyer's fee. This implies that the proper target for our economy is $\gamma^S = \gamma^B = 0.022p$.

Parameter	Description	Value
μ	Realtors' Market Matching Efficiency	0.5
μ^B	Matching Efficiency for Buyers	2.3
μ^S	Matching Efficiency for Sellers	2.45
α_f	Customers' Market Matching Elasticity	0.18
k	Housing Cost	35.37
c^B	Buyers' Search Cost	5.6
c^S	Sellers' Search Cost	0.25
c^{RB}	Realtors' Search Cost Representing Buyers	0.05
c^{RS}	Realtors' Search Cost Representing Sellers	0.22
ϵ	Elasticity of Congestion in Realtor Entry	2

Table 2: Internally Calibrated Parameters

and 17% lower sales compared to the directed search model. Moreover, the market is less liquid under random search with 22% more vacant houses and almost 50% longer time needed for a property to be sold. Intuitively, by not allowing agents to post prices and fees, the random search model leaves some gains from trade on the table and makes the housing market less liquid. This slowdown is reflected in realtor entry: total realtor mass is 2.5% smaller in the random than the directed search model. Moreover, the composition of realtor activity shifts towards sellers who are represented by a larger mass of realtors under random than directed search, while the opposite holds for buyers. These effects on realtor entry and composition increase congestion which affects the two sides of the market differently: buyers' fees decrease, while sellers' fees increase with random search.

						Realtor Fees		Realtor Masses	
Endogenous Variables	Price	Sales	Vacancies	Buyers	TTS	Buyer	Seller	Buyer	Seller
Directed Search Model	38.03	3.76	7.53	7.53	2	2.5%	2.5%	13.05	8.14
Random Search Model	38.99	3.12	9.21	5.80	2.95	2.16%	3.26%	10.91	9.75

Table 3: Steady-state levels of endogenous variables in the benchmark directed search model and in the model with random search

An important implication of the comparison between the two models is that the effects of the recent housing market reform will not be the same for all market participants. In total, sellers gain from a transition from directed to random search. Even though both commission fees and time-to-sell increase, the sellers' net revenue, $p - \gamma^S - c^S/[\theta m(\theta)] - c^S/p(\phi^S)$, increases by 1.1%. Intuitively, the reform improves the sellers' relative position and they are able to pass through a large fraction of the higher fees and search costs to the buyers through the elevated house prices. Moreover, sellers have a larger mass of realtors to work with in the random than the directed search equilibrium. Buyers experience the transition from directed to random search differently. On the one hand, they face lower commission fees and search costs, due to the increased time-to-sell. On the other hand, they see a sharp decrease in the realtor services provided to them, as well as a large increase in house prices. In sum, the total cost of securing a house, $p + \gamma^B + c^B/m(\theta) + c^B/p(\phi^B)$, is predicted to increase by 0.01%. Even though this may seem like a small magnitude, it strongly disincentivizes buyers' entry in the market, with the total buyers' mass being reduced by 23%.

Overall, there are two major lessons to be drawn from these results regarding the recent NAR settlement. First, the intended consequences of the settlement will be only partially met: sellers' revenue is expected to increase but buyers will not see a reduction in their cost of purchasing a house. This is true even when the predicted reduction in the buyers' search costs are taken into account. Second, our model comparison suggests an important unintended consequence of the settlement: the market liquidity is expected to decrease and this will substantially reduce welfare. In the random search equilibrium, the combination of longer time-to-sell, more vacant houses, and lower buyer entry results in a 17% decrease in homeownership rate. This result also highlights the importance of explicitly modeling endogenous entry and meeting rates between realtors and customers, since results of this type would be impossible to obtain in models without these features.

Impact of 1% Increase in ε						Realtor Fees		Realtor Masses	
	Price	Sales	Vacancies	Buyers	TTS	Buyer	Seller	Buyer	Seller
Directed Search Model	0.15%	36.81%	31.33%	37.87%	-4%	16.11%	9.73%	13.71%	21.44%
Random Search Model	0.48%	35.90%	35.90%	35.90%	0.001%	13.81%	12.72%	13.65%	21.80%
Impact of 1% Increase in k						**Realtor Fees**		**Realtor Masses**	
	Price	Sales	Vacancies	Buyers	TTS	Buyer	Seller	Buyer	Seller
Directed Search Model	0.85%	-19.56%	-17.85%	-19.88%	2.13%	-10.02%	-6.97%	-8.77%	-12.80%
Random Search Model	0.63%	-19.23%	-19.66%	-19.15%	-0.53%	-8.85%	-8.54%	-8.78%	-12.99%

Table 4: Percentage changes of endogenous variables in the benchmark directed search model and in the model with random search following a 1% increase in: (i) homeownership utility, and (ii) the cost of new housing.

Finally, to better understand the mechanics of the two search protocols, we present a series of comparative statics exercises. In particular, we show the implications of each model for an increase in housing demand (modeled as a 1% positive shock in homeownerhsip utility ε), as well as a decrease in housing supply (modeled as a 1% positive shock in the housing cost k). Table 4 summarizes the results. As expected, both shocks increase housing prices, but the positive demand shock also raises sales while the negative supply shock lowers sales. Overall, the two models predict responses of similar magnitude in the endogenous variables following both shocks. In other words, we should not expect the NAR settlement to have a sizable impact on the volatility of the housing market.[10]

6 Conclusion

This paper builds a search model of the housing market to explore intermediation and market liquidity, focusing on the role of realtors in facilitating transactions between buyers and sellers. The environment includes three types of agents: households (who may wish to buy or sell a house), real estate developers (who supply new homes), and realtors (who represent buyers and sellers). Preference shocks incentivize homeowners to sell their house, while non-homeowners are actively seeking to buy a property. The model features three types of meetings: between buyers-realtors, sellers-realtors, and realtors-realtors, all of them subject to search frictions modeled with matching functions. Crucially, in this framework the transaction speed and market liquidity emerge as endogenous outcomes that depend on agents' entry in the housing market.

The analysis employs two search protocols: directed and random search. In the directed search model, sellers post house prices and realtor fees, while buyers and realtors search for the most profitable opportunity. This setup mirrors the pre-2024 U.S. housing market regime, where sellers traditionally paid all realtor commissions. In contrast, the random search model represents the post-2024 market, where realtor commissions are decoupled from house prices, and buyers negotiate directly with their realtors for commission rates. This change was prompted by the 2024 settlement between the National Association of Realtors (NAR) and home sellers' associations, aiming to address concerns about excessive realtor commissions in the U.S. housing market.

[10] The only noteworthy difference seems to be the response of the time-to-sell, for which the random search model predicts smaller responses than the directed search model for both shocks. This may be an intended gain of the reform: by disconnecting prices and fees from entry, the NAR settlement may have made the time-to-sell in the housing market less sensitive to external shocks.

The main exercise of the paper is to evaluate the consequences of the recent NAR settlement through the lens of our search model. Contrary to media expectations, our model predicts that the settlement leads to only a partial fulfillment of its intended effects. The random search model predicts a 2.5% increase in house prices and a 17% reduction in the volume of home sales compared to the directed search equilibrium. Moreover, the settlement has asymmetric distributional effects: it benefits sellers by increasing house prices and expanding the pool of realtors representing them, but it harms buyers by making homes more expensive and harder to purchase. In total, the model predicts a 23% decline in the number of buyers in the market under random search. The main driver behind these results is the reduction in market liquidity, as random search lowers the efficiency of the housing market, resulting in lower buyer entry and longer times for homes to sell. The analysis highlights the importance of accounting for endogenous realtor entry and meetings between realtors for a comprehensive evaluation of housing market policies.

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