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Utilizing Machine Learning for Anchoring and Addressing Asymmetric Information in the Real Estate Market

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Abstract: ***Common belief proposes that individuals purchasing homes from outside the local area typically incur a premium. According to conventional contract theory, this premium may result from the elevated expenses associated with gathering information. On the other hand, behavioural economists contend that the premium is attributed to anchoring biases in the buyers' perceptions of information. While both theories endorse the notion of a price premium, conflicting empirical evidence exists. This study reexamines this puzzle and conducts a rigorous examination of the two alternative hypotheses. We utilize a substantial housing transaction dataset from India available online to shed light on this issue. A cutting-edge machine-learning algorithm, incorporating the latest advancements in natural language processing for multiple languages, has been devised to identify non-local Mainland Chinese buyers and sellers. Employing the repeat-sales method to mitigate omitted variable biases, it is observed that non-local buyers tend to purchase at higher prices, while non-local sellers engage in transactions at lower prices compared to their local counterparts. Leveraging a policy change in transaction tax exclusively targeting non-local buyers as a quasi-experiment, and using local buyers as counterfactuals, our findings reveal a shift in the non-local price premium to a discount post-policy intervention. This outcome suggests that the dominance of anchoring biases hypothesis is evident.***

Keywords: Anchoring bias, Machine learning, Housing transaction.

I. INTRODUCTION

For the majority of homeowners, their residence constitutes the primary asset in their financial portfolio. Particularly for younger households who own homes, the value of the house can significantly outweigh the household's net wealth (Flavin and Yamashita, 2009). Consequently, the sale of a home becomes a pivotal financial transaction, often representing the most substantial monetary event in the homeowners' lives. This is a recurring scenario for typical home-owning households, with approximately 12% of such households in the United States relocating over a two-year span (Ferreira, Gyourko, and Tracy 2008, drawing from 1985-2005 AHS data). Amidst the myriad of decisions involved in a home sale, one of the most challenging is determining the initial "listing price." However, despite the significance and regularity of home sales, the existing research literature has not provided a definitive recommendation regarding the fundamental strategy sellers should adopt. In this current research, we address this issue by examining insights from three distinct bodies of literature, analyzing a comprehensive and diverse dataset of market transactions, and comparing our findings with both realtors' recommendations and their personal beliefs.

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Research on anchoring and insufficient adjustment (Tversky and Kahneman, 1974) has consistently shown that exposure to even irrelevant numbers leads individuals' subsequent quantitative judgments to align with the provided "anchor." This anchoring phenomenon influences the prices consumers are willing to pay for goods and experiences (Ariely, Loewenstein, Prelec, 2003; Green, Jacowitz, Kahneman, & McFadden 1998; Northcraft & Neale, 1989; Simonson & Drolet, 2004) and affects the outcomes of distributive negotiations (Galinsky, Leonardelli, Okhuysen and Mussweiler, 2005; Galinsky and Mussweiler, 2001; Galinsky, Mussweiler and Medvec, 2002). Considering the available evidence for anchoring effects, it suggests that home sellers may gain advantages from establishing higher listing prices.

Nevertheless, this conclusion stands in stark contrast to the prevailing view in much of the economic literature, which regards housing prices as rational and primarily influenced by factors such as location and amenities (Sheppard, 1999). According to this perspective, market forces are anticipated to rectify any strategic pricing behaviors. Results from laboratory experiments illustrating a connection between initial prices and eventual selling prices are typically disregarded, attributed to experimental demand in the absence of real market conditions. Conversely, instances of anchoring-like effects observed in market data are frequently criticized for not adequately controlling for potential confounding variables.

II. Literature Review

A third body of literature, focusing on auction behavior (Gneezy, 2005; Gneezy & Smorodisky, 2006), provides an additional set of predictions. The typical home sale initiates an auction-like process, where one or more buyers may submit offers in response to a listing price. Recent research indicates that auctions commencing with lower asking prices attract more bids and ultimately result in higher closing prices (Ku, Galinsky, and Murnighan, 2006; Ku, Malhotra & Murnighan, 2005; Simonsohn and Ariely, 2007). This trend is attributed to "herding" behavior (Banerjee, 1992), where early bids signal competitive pricing, prompting others to join the bidding. Indeed, an analysis of real estate-related content online indicates that there is a professional consensus favoring the strategy of setting a home's price low in the hope of initiating a competitive "bidding war."

Recent research conducted by Janiszewski and Uy (2008) delved into the impact of listing prices on the residential housing market. However, the focus of their study was on the effect of price precision. Consequently, they opted to exclude all transactions involving multiple offers from their dataset, precluding an examination of herding behavior as an alternative explanation. Hence, the query of whether a seller should set a relatively high or low price in the context of a significant, information-rich market transaction remains largely unresolved. In this present study, we investigate the issue of initial listing prices in the real estate market through two distinct methods. Initially, we collect professional advice accessible to homeowners through the internet. Subsequently, we analyze the content and tone of published articles to discern the recommended strategies advocated by real estate agents.

Despite the inclination in online recommendations from real estate agents favoring underpricing and suggesting a potential herding effect, our market data do not lend support to this strategy. Surprisingly, underpriced homes consistently performed less favorably in the examined data, even in active markets with frequent transactions. Conversely, our market data reveal indications of an anchoring effect, persisting even after considering "fishing" behaviors, where home sellers wait for an extended period to secure a higher offer (Bokhari & Geltner, 2011). Interestingly, the private beliefs of agents align more closely with our market findings rather than their public recommendations. In anonymous surveys, real estate agents predicted that higher listing prices would result in higher sale prices, even after accounting for individual differences, property fixed effects, and listing time expectations.

Our approach extends beyond previous literature in several dimensions. Firstly, we illustrate the impact of listing strategies on final prices by employing a substantial dataset of real market data within the context of a high-stakes, information-rich transaction. Secondly, we employ innovative empirical methods to eliminate alternative explanations that have posed challenges

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in prior attempts. Lastly, through the comparison of market data with recommendations from professional realtors, we highlight a probable disparity in lay knowledge concerning one of the most significant financial transactions in the lives of most consumers.

III. Study 1 – Expert Consensus on Pricing

To initially explore the prevailing professional opinions on over- and underpricing, we turned to a common source of information for many home sellers: the internet. Our analysis encompassed the first 100 web pages retrieved from Google searches, including "home + over-pricing + sell," "home + under-pricing + sell," "pricing + strategy + sell + home," and "pricing + home + for + sale." Of these pages, 297 provided professional advice on setting the initial listing price.

Three independent raters, unaware of the hypothesis, evaluated the content. Among the 94 web pages discussing under-pricing, 46% recommended it as a viable strategy. Conversely, of the 163 pages discussing over-pricing, a significant majority (96%) cautioned against adopting such an approach.

Although this initial analysis provides a clear understanding of the advice available online, one may question the sincerity of such recommendations. The real estate market grapples with the standard agency problem as realtors typically earn only a small commission based on the transaction price (Anglin and Arnott 1991; Geltner, Kluger, and Miller 1991; Levitt and Syverson 2008; Miceli 1991; Rutherford and Yavas 2012). Moreover, internet advice may not accurately reflect the private beliefs of realtors. Therefore, in Study 1, we delved into the degree to which realtors privately endorse the publicly recommended under-pricing strategy. This was achieved by presenting expert participants with specific properties and soliciting their pricing recommendations and expectations concerning transaction outcomes.

Method

Participants:

A total of thirty-five local realtors (42.9% female, with an average age of 44.7 years and an average of 6.8 years of real estate experience) participated in the online study conducted between March 28 and May 2, 2011. Participants were compensated through entry into a lottery for a $100 Amazon.com gift card.

Procedure:

We randomly selected ten homes listed for sale in Montgomery and Philadelphia Counties of Pennsylvania in October 2010. Each participant reviewed detailed descriptive information about six randomly selected homes, with three situated in Montgomery County ("suburban setting") and three in Philadelphia County ("city setting"). Subsequently, they were presented with the median listing price of homes in the same zip code in October 2010, as per Zillow.com. Participants were then tasked with providing a recommended listing price for each home, along with predicting the anticipated final sale price and the expected duration on the market based on the recommended listing price.

Results and Discussion:

Upon excluding data from one realtor who inputted all listing prices as $1 and another observation where the expected time-on-market was entered as 169,000 days, our analysis encompassed 203 valid observations. We classified "under-pricing" as recommending a price of 99% or less of the median price and "over-pricing" as recommending a price that is 101% of the median price. Participants advocated for under-pricing in 70.4 percent of cases. Ten out of the 34 realtors recommended under-pricing for all six homes they evaluated, while the remaining 24 proposed a combination of over- and under-pricing strategies.

Analysis of Participants' Expectations on Transaction Outcomes:

To scrutinize participants' expectations regarding the impact of their strategies on transaction outcomes, we conducted a regression analysis. The dependent variable was the percentage difference between the expected sale price and the reference

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price, with the realtors' recommended strategy as the main predictor. The analysis controlled for participant and property fixed effects, as well as the anticipated time-on-market.

Our findings revealed that when realtors recommended under-pricing, they anticipated the home to sell for a significantly lower amount than the reference price ($B = -6.21$, $t = -2.14$, $p < 0.05$). Conversely, when realtors recommended over-pricing, they expected the home to sell for a significantly higher price than the reference price ($B = 16.83$, $t = 3.58$, $p < 0.001$). Importantly, as property and realtor fixed effects were controlled for, this pattern is not influenced by property characteristics or realtor disposition. Additionally, we regressed realtors' expected time-on-market on the recommended pricing strategy, considering participant and property fixed effects. However, we observed no significant relationship for either under-pricing ($B = 7.02$, $t = 1.11$, ns) or over-pricing ($B = -4.53$, $t = -0.43$, ns).

Interpretation of Data Findings:

Our data indicate a noteworthy discrepancy in the perspectives of realtors: while they often recommend underpricing, their beliefs suggest that homes listed below comparable properties tend to sell at lower prices, and those listed higher than comparable homes fetch higher prices. Importantly, as there is no observed relationship between realtors' recommendations and their expectations regarding time on the market, it is not conclusive that these recommendations are solely self-serving.

This incongruity in realtors' perspectives might mirror a phenomenon observed in decision science, where professionals entertain two conflicting sets of predictions about the impact of listing prices on selling prices—one based on herding and another based on anchoring. In the forthcoming Study 2, we leverage a substantial and diverse dataset of transaction data to investigate which of these processes genuinely occurs in a real market context.

IV. Study 2: Analysis of Listing Strategies in the Housing Market

In this second study, we employ a comprehensive dataset comprising all residential real estate transactions listed on the MLS (Multiple Listing Service) from 2005 to 2009 in Delaware (DE), New Jersey (NJ), and Pennsylvania (PA). The primary aim is to scrutinize the correlation between listing prices and final sale prices. To address potential alternative explanations rooted in seller motivations or property characteristics for any observed relationship, we employ innovative empirical approaches.

Laboratory investigations into anchoring have revealed two underlying mechanisms explaining why a higher listing price may lead to a higher selling price. Firstly, individuals tend to insufficiently adjust away from prominent anchors (Epley & Gilovich, 2006). Consequently, a home buyer exposed to a high listing price might downwardly adjust but cease adjusting once they reach the highest amount they are willing to pay for the property. Secondly, individuals have a tendency to generate more arguments that align with rather than contradict the anchor (Strack & Mussweiler, 1997; Mussweiler, Strack & Pfeiffer, 2000). Consequently, a buyer exposed to a high-priced property might focus more on its appealing landscaping than its outdated plumbing. This conceptualization, known as the "selective accessibility model" of anchoring, has been applied to elucidate the impact of opening prices on selling prices in laboratory negotiations (e.g., Galinsky & Mussweiler, 2001).

The primary difficulty in substantiating anchoring effects through market data lies in establishing that the relationship between listing prices and selling prices is not solely a result of objective home qualities. Therefore, to discern the impact of over- or underpricing a home, it is imperative to determine the sale price a given home would command based on objective characteristics, assuming listing behaviors had no influence. To approximate the expected sale price using objective criteria such as the number of bedrooms, bathrooms, and lot size, we conduct a hedonic sale price regression utilizing a dataset encompassing 331,541 home sales from all MLS transactions in Delaware, New Jersey, and Pennsylvania from January 2005 to April 2009 ($R2 = 0.785$). To bolster the robustness of our findings, we employ a total of six alternative reference points other than the price predicted by our regression.

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Another challenge arises when a home is priced higher (or lower) due to qualities that hold significance for buyers but remain unobserved by the econometrician (e.g., abundant sunlight or a particularly appealing layout). To address this concern, for each listing that we could match to a prior sale, we computed the portion of the previous sale price that our hedonic regression did not anticipate. We interpret this as a gauge of the time-constant unobserved home qualities that, in part, influenced the previous sale price. As long as these qualities remain relatively stable over time, the residual term from a previous sale price prediction serves as a reasonable, albeit noisy, proxy for their impact on the future sale price.

Method

1. **Data**
2. **Main Data Set – Multiple Listing Service Data:**

We gathered data on all homes sold in Delaware, New Jersey, and Pennsylvania, listed through the Multiple Listing Service (MLS), spanning from January 2005 to April 2009 (MLS data). After excluding non-arms-length transactions (e.g., sales between family members) and extreme outliers (listings with a sale price below $1,000 or a total area below 10 square feet), we retained 335,852 observations across more than a thousand zip codes (refer to Table 1).

3. **Repeat-Sale Data:**

For our primary analysis, we utilized the 14,616 complete records for homes that were matched to a previous sale. Regarding home listings outside of Philadelphia County, we were limited to matching repeat-sales between January 2005 and April 2009. To augment the Philadelphia County MLS data, we supplemented it with complete home sale tax records for Philadelphia County from 1988 to 2004 (PHL data), encompassing 148,331 usable observations.

4. **Creating the Predicted Sale Price:**

Utilizing a hedonic regression on the sale price per square foot, incorporating 331,541 home sales with comprehensive property and transaction information spanning from 1988 to 2009 (R2 = 0.785), we generated a predicted sale price for each property at the time of listing in the MLS data. The hedonic regression on price per square foot controlled for various variables, including lot size, floor-to-area ratio, property type (semi-detached, attached, detached), exterior material type, a garage indicator, number of fireplaces, a dummy variable for an irregular lot, central air conditioning, a quadratic time trend, as well as fixed effects for month, school district, and zip code.

5. **Market Warmth:**

Based on the year-on-year change in housing transaction volume, we classified each zip code in a given month and year into one of seven categories, indicating market warmth or thickness: hot (up by 30% or more), warm (up by between 20 to 30%), lukewarm (up by between 10 to 20%), cool (down by between 10 to 20%), cold (down by between 20 to 30%), dead (down by 30% or more), or neutral.

6. **Variability in Listing Prices:**

Increased variability in listing prices within a specific zip code significantly diminishes the correlation between pricing strategies and log sale price. This trend holds true across various specifications. The observed pattern aligns well with an anchoring interpretation grounded in the availability of anchor-consistent information (Strack and Mussweiler, 1997). In zip codes characterized by high listing price variability, the existence of homes with comparable fundamental features but listed at diverse prices may furnish sellers with salient evidence that contradicts prevailing anchors. Moreover, if unobservable home qualities were the primary driver of our observations, we would anticipate them to exert a more pronounced influence in zip codes with greater variability, resulting in an intensified, rather than diminished, listing price effect.

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While intriguing in their own context, these findings contribute further support to the notion that unobservable qualities are not the primary driver of our outcomes. Given the well-documented impact of impending foreclosure on the deterioration of homes (Skogan, 1990), it is plausible that unobservable qualities exert a more significant influence in elucidating the underpricing effect. The absence of asymmetrical amplification of pricing effects in our data contradicts this notion. On the contrary, the symmetrical amplification aligns with anchoring, a phenomenon known to be more pronounced in environments characterized by heightened uncertainty (Mussweiler & Strack, 2000).

V. General Discussion

The sale of a home represents the most consequential financial transaction for the typical home-owning household. Despite the considerable importance and careful consideration involved in this transaction, existing research has not definitively addressed the optimal strategy for sellers to pursue. Our study reveals that, contrary to prevailing professional advice favoring underpricing, opting to overprice one's home in relation to various benchmarks employed in our analyses leads to a higher sale price, while accounting for the duration of the sales process. These outcomes persist even when incorporating controls for unobservable home quality and time-on-market.

Our findings, derived from a high-stakes and information-rich context, preclude arguments that attribute the observed effect to individuals' oversight, a lack of decision aids, or the absence of viable alternatives. The demonstrated effect proves robust and statistically significant, emphasizing its substantive impact.

VI. Research Advancement

Our study surpasses previous endeavors to elucidate pricing effects in the real estate sector in several key ways. Firstly, we employ a more extensive dataset, enabling us to experiment with a diverse range of reference points and more effectively allay concerns related to unobservable variables. These encompass home qualities, marketing strategies endorsed by listing offices, time on the market, and fixed effects for zip code, school district, listing office, year, and month. Secondly, we delve into the potential variation in over- and under-pricing influenced by local market conditions. Our approach involves utilizing both changes in transaction volume at the zip code level and data on listing price heterogeneity, providing a more robust examination of both herding and anchoring hypotheses. Contrary to widely circulated anecdotes about market excitement and bidding wars, our findings indicate minimal or no herding effect in a hot market.

VII. Reconciliation of Findings with Professional Advice

Although our findings starkly oppose the advice commonly dispensed by real estate professionals to their clients, they appear consistent with the underlying beliefs held by realtors themselves. In Study 1, participants predominantly advocated for underpricing, concurrently expecting this strategy to yield lower sale prices. The tone of caution against overpricing, as discerned from the online content we collected, aligns with an article from About.com titled "The Worst Home Selling Mistake," which vividly recounts the story of a house that, according to the author, failed to sell due to a combination of agent inexperience and seller greed, resulting in a property deemed "stale, dated, a market-worn home that was over-priced for too long."

Despite the prevalent advice encouraging underpricing to potentially trigger a bidding war, our market data-based findings strongly advise sellers to exercise caution and reconsider the temptation to underprice a property.

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