USING ARTIFICIAL SWARM INTELLIGENCE TO IDENTIFY INEFFICIENCIES IN REAL ESTATE PRICING METHODS

Next-generation AI technology can predict which homes will be improperly priced, allowing home builders to take corrective action.

Summary

Many popular methods for pricing new homes are inefficient. Local or regional home construction firms may lack the means to precisely calculate prices for the houses they built. Often, a builder will simply add a flat rate to their costs, while more meticulous approaches can involve simple comparisons to similar homes in the area. Neither of these methods, however, can be reliably used to determine the optimal price. A more precise methodology would produce more accurate pricing and generate considerable value. Swarmalytics Labs has created such a methodology utilizing massive amounts of proprietary data and advanced analytics technology.

The technology used to explore data is artificial swarm intelligence, an analog of the natural collective intelligence observed in flocks of birds, schools of fish, swarms of bees, etc. In artificial swarm intelligence, thousands of intelligent agents simultaneously search a data landscape for patterns and communicate their findings to each other. When applied to predictive analytics, the swarm of intelligent agents subdivides a problem into homogeneous segments, creates a solution for each segment, and finally reunites the solutions into an ultimate equation that is greater than the sum of its parts.

Introduction

New homes are currently priced using unrefined methods. The most inefficient method involves adding a flat percentage to building costs, while a slightly more thorough approach may compare similarly sized homes in the area. Yet simple comparisons alone cannot create a truly accurate price point. Swarmalytics has developed a nationwide model that incorporates artificial swarm intelligence along with terabytes of relevant data to create a precise pricing methodology. This pricing methodology would generate significant value for home builders, as an optimal price can be calculated for every home built.

Background
The New Home Market

The United States saw over half a million new single-family houses sold in December of 2022 alone[1]. With home prices rising steadily since 2020, reaching a median value of about $450,000 by Q2 2022[2], even marginal inefficiencies in pricing mean that billions in revenue are left on the table annually. Prominent pricing techniques for home builders typically involve either an addition of a flat percentage to building costs (called cost-plus pricing), or setting a price based on similar homes in the area (comp-based pricing). Both techniques are unreliable in calculating the optimal price for a home, however, as they only consider a small number of data points. Cost-plus pricing is dependent only on factors related to the construction itself such as material costs, number of rooms, lot price, and on-site amenities such as swimming pools or patios. Comp-based pricing is a moderately better methodology as it includes additional data points including local amenities. However, neither of these pricing methods gather the full range of information about a home such as crime statistics, traffic flows, or performance of local schools, to name only a few. These other market factors can be captured through careful data collection from numerous sources.
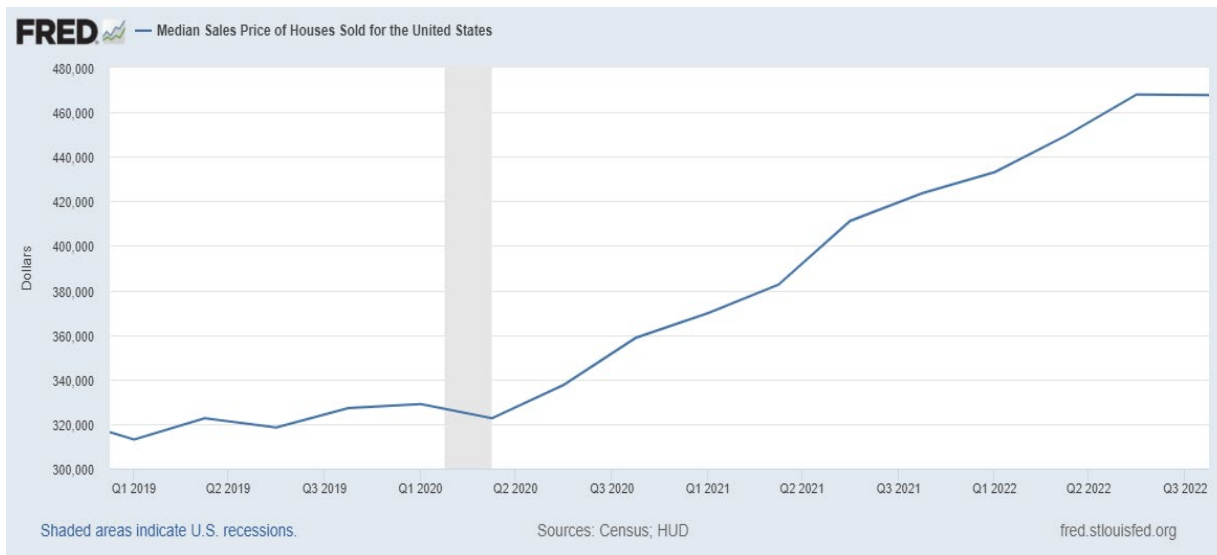
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FIGURE 1: RISING HOME PRICES IN THE U.S.

The median price of homes sold in the U.S. grew from roughly $320K in Q2 2020 to over $460K two years later, an increase of over 40%.

There are massive amounts of data to be gleaned from the real estate world, leading to what has been called the "third phase of PropTech"[3]. Just some of the available data includes housing data, population characteristics, and regional and local economic data. However, accumulating and utilizing this data is far from simple. Advanced data collection and manipulation techniques, developed by Swarmalytics Labs, have overcome this obstacle to create a massive proprietary dataset for analysis.
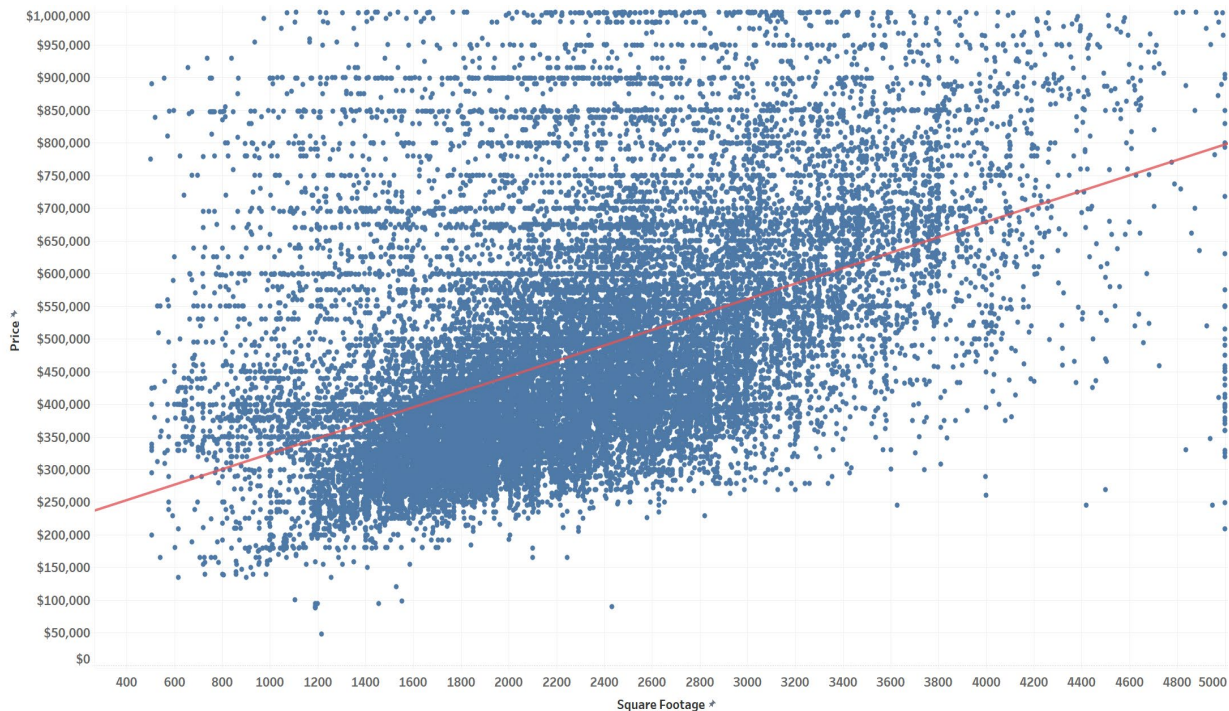
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FIGURE 2: PRICE VS. SQUARE FOOTAGE – HOUSTON, TX SAMPLE

While it is evident that there is a relationship between price and the square footage of a home, other factors must be analyzed to explain the variance in price across similarly sized homes. In this sample of homes in Houston, similarly sized houses are listed at a large range of prices.

Artificial Swarm Intelligence

Manual analysis of this data is out of the question; data of this magnitude can only be efficiently analyzed using artificial intelligence to search for predictive relationships at extremely high speeds. Swarmalytics' artificial swarm intelligence engine has this capability. Research into swarm intelligence and its applications dates back to the late 1980s. Examples of early milestones include the creation of Boids, an artificial life program written by Craig Reynolds in 1986 using simple rules to create a simulated flock of birds[4], and the 1992 publication of Marco Dorigo's Optimization, Learning, and Natural Algorithms, which laid the groundwork for ant colony optimization algorithms[5]. In the decades since, the study of swarm intelligence has continued to bear fruit. For example, Southwest Airlines' efficient open-seating policy was born out of swarm intelligence[6], which is also used to navigate their pilots to airport gates most efficiently[4]. More recently, Fortune Magazine explored the power of swarm intelligence to transform the financial world in its November 2021 article Following the Flock – The Science of Meme Stocks and Manias[7], and a May 2021 article from Harvard Business Review highlighted the innovative uses of swarm intelligence across companies such as Hewlett-Packard, Unilever, and Capital One[8].

Developing a National Home Pricing Model

Swarmalytics' national home pricing model began with the cultivation of terabytes of data, including descriptions of the property itself (lot size, construction date, and number of bedrooms and bathrooms, among other factors), population characteristics, regional economic data, local crime statistics, price histories, local business characteristics, proximity to emergency services, local traffic flow data, and much

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more. These data were combined from meticulously curated proprietary datasets. The final dataset contained over 145,000 newly constructed homes with two thousand variables available for analysis.

The dependent variable for this analysis was created by dividing the price of each individual home by the home price of similar houses in the area. Houses were deemed similar to the individual home if they had the same number of bedrooms and bathrooms, same square footage, and shared the same United States Postal Service Sectional Center Facility indicating a similar geographic location. Swarmalytics evaluated nearly endless combinations of the two thousand available variables in competing equations, searching for a near-perfect relationship. In the end, it found specific market factors that influence price, creating a model that can predict when a house can be sold for up to 110% more than the median price of similar homes in its area. Ultimately, the model can be used to calculate the optimal price for any newly constructed home in the U.S.
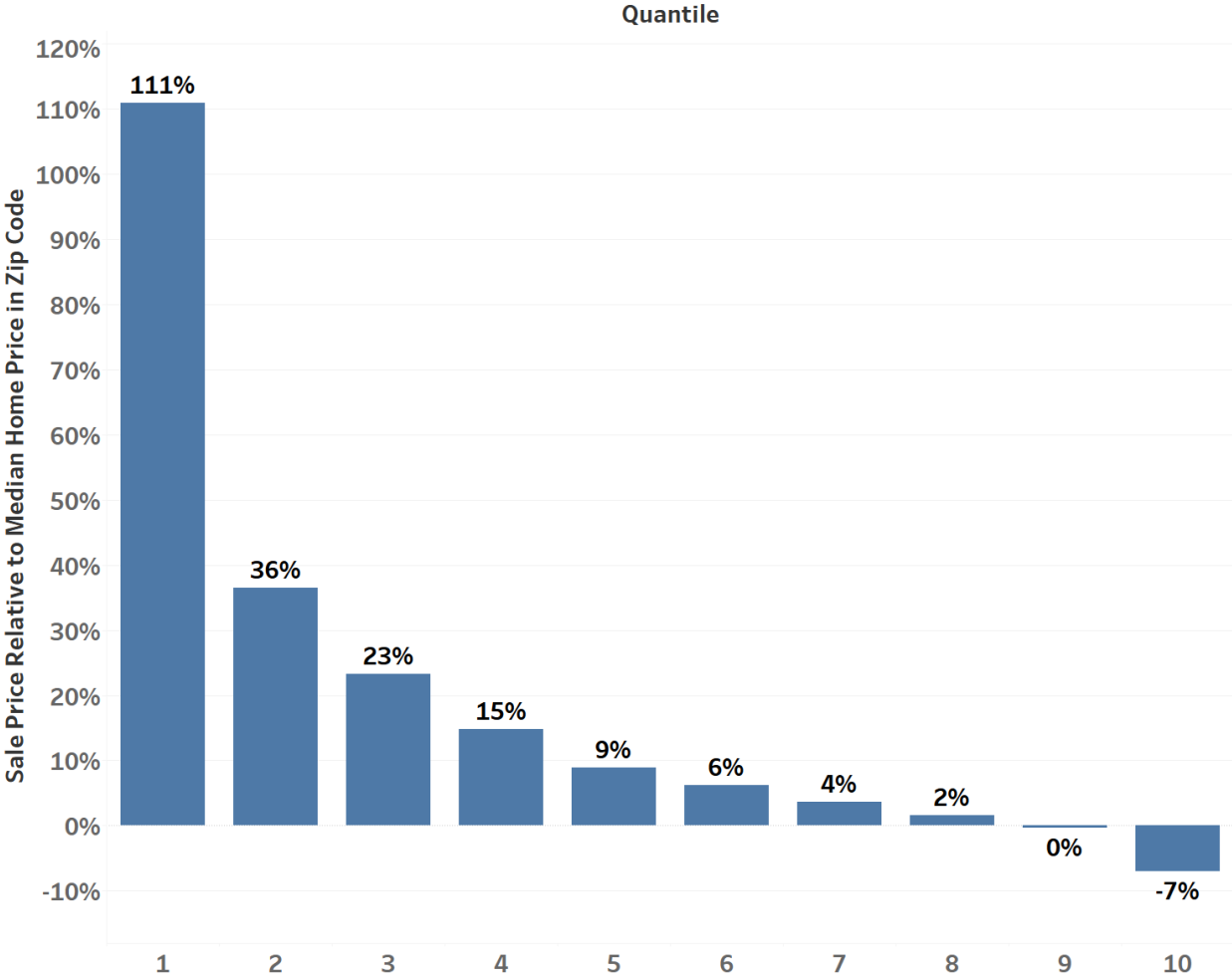

FIGURE 3: SALE PRICE VS. LOCAL MEDIAN PRICE BY SCORE QUANTILE

Using artificial swarm intelligence, Swarmalytics has created a model which can accurately predict which homes can be sold at a price that is over 110% higher than the median home price in the surrounding area.

Conclusion

While the housing market has grown in recent years, pricing inefficiencies are potentially leaving billions on the table. New property technology, developed by Swarmalytics Labs, has the capacity to optimize pricing for any newly constructed home in the United States. Using massive proprietary datasets, combined with cutting edge artificial swarm intelligence, the missing billions of dollars can be realized through precise home pricing.

Moving forward, Swarmalytics will be able to improve its predictive power through targeted modeling of select areas. By narrowing the data for analysis to only include the data relevant to the immediate area of interest, price calculations can be even more precise. In addition, as new homes are built, the dataset will be updated to include their information, enhancing its precision. As the model continues to be refined, the optimization of pricing will provide immense value to home builders in perpetuity.

About Swarmalytics

Swarmalytics, Inc. was founded in 2021 by CEO Doug Newell and CTO Dan Koehler with the goal of using artificial swarm intelligence to power insights and create value. To learn more about Swarmalytics, please visit www.swarmalytics.com.

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Citations

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