INVESTIGATING THE RELATIONSHIP BETWEEN INVESTOR ATTENTION AND HOUSE PRICES USING GOOGLE TRENDS: A CASE STUDY OF AUSTRALIA

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# Abstract

In a market economy, the housing market and house prices play crucial roles, influencing various aspects of the overall economy. Despite the housing market receiving significant attention from researchers and practitioners, previous literature has not directly examined the link between investor attention and house prices. By conducting an empirical investigation, this research aims to contribute valuable insights to this relation and the existing literature on house prices. The study employs cross-correlation analysis with a dataset collected from public sources, such as the Google Trends and FRED database, covering the time span from the first quarter of 2004 to the first quarter of 2023. The findings suggest that fluctuations in investor attention are closely associated with changes in house prices. This paper thus introduces one of the pioneering frameworks that bridge two critical domains: investor attention and housing market, in the context of Australia in the era of information technology.

Keywords: Investor attention, house price, Australia, housing market.

# Introduction

It is widely acknowledged that the housing market and house prices are important components of a market economy and have significant impacts on other aspects of the economy (Aizenman et al., 2019, Anari and Kolari, 2002, Bajari et al., 2005, Englund and Ioannides, 1997, Miller et al., 2011). Earlier studies have found that house prices are a reliable indicator of inflation, consumer spending, household expenditure as well as economic growth (Aizenman et al., 2019, Anari and Kolari, 2002, Bajari et al., 2005, Miller et al., 2011). On the individual level, houses are often perceived as the major asset as well as the main debt held by households. Thus, any large movements in house prices could have significant consequences on both individual financial stability and macroeconomy.

From a theoretical perspective, housing is also a type of commodity, its price adheres to the theory of supply and demand (Chow and Niu, 2015). The supply of houses is closely tied to the availability of land, with land being inelastic in the short term. On the other hand, house prices are mainly influenced by housing demand, driven primarily by both investment and speculative factors. While investment demand is linked to economic fundamentals and consumer preferences, speculative demand depends on expected returns from housing investments. To gain a better understanding of investor sentiment and preferences, investor attention can be regarded as a valuable tool (Mbanga et al., 2019, Ding et al., 2019, Sampath et al., 2022).

In the realm of financial markets, the phenomenon of investor attention has emerged as a compelling force, capable of influencing asset classes and shaping market dynamics (Pham and Huynh, 2020, Zhu et al., 2021). Following the asset pricing theory and behavioural finance theory, when investor sentiment is high, attention to assets increases, leading to high information searches. Conversely, low sentiment indicates reduced interest and fewer searches. This sentiment and interest of investors are key factors impacting preferences, decisions, and subsequently, housing demand. Positive sentiment prompts stronger willingness to buy, shorter trading waiting times, and increased investment and speculative demand. In contrast, negative sentiment leads to decreased willingness to buy, longer trading waiting times, and reduced investment and speculative demand, ultimately affecting housing demand. This highlights that while short-term housing supply is relatively stable, changes in demand directly influence housing prices. Furthermore, investor attention can potentially play a significant role in influencing short-term fluctuations and long-term trends in house prices. It suggests that analysing information search data can support in predicting and providing insights into future housing price fluctuations. This study will therefore use information search data to measure investor attention, gauge their sentiment, and assess their potential impact on the housing market.

As the housing market exerts far-reaching impacts on economies and societies, understanding the potential linkage between investor attention and house prices becomes a vital pursuit. This paper is thus among the first empirical studies of investor attention within the context of the housing market. Our empirical results show positive correlation between investor attention and house prices, which hold substantial importance in understanding the role of investor attention in the housing market and contribute to a more comprehensive understanding of the intricate dynamics that drive housing prices and trends. By shedding light on the correlation between investor attention and house prices, this research strives to advance our understanding of market behaviour and contribute to informed and sustainable financial practices. To our knowledge, our research is the first to evaluate the helpfulness of Google search data in the context of investor attention and housing market in Australia. The results also provide relevant information for investors and policymakers on the dynamics of housing markets to assist in their prudent decision making and policy formulation.

Our paper proceeds as follows. Section 2 highlights previous literature; Section 3 summarises data characteristics and main analysis methods; Section 4 presents the results and discussions; Section 5 demonstrates the result of robustness test; and Section 6 provides the conclusion.

# Related literature

## Investor attention and house price

Previous studies that have focused on housing prices demonstrate relationships between housing prices and primary economic indicators, such as the unemployment rate, economic growth, and inflation. For example, the connection between unemployment rates and house prices has undergone extensive examination. Ernst and Saliba (2018) found that real estate shocks can have lasting impacts on employment, with housing booms temporarily boosting economic growth and employment. Similarly, Liu et al. (2016) observed an inverse correlation between land prices and unemployment during business cycles. Irandoust (2019) identified a one-way causal link between house prices and unemployment in European countries. Furthermore, the impact of property prices on economic growth is another area of research. Aizenman et al. (2019) noted a positive correlation between property price appreciation and economic growth, while depreciation could stimulate or restrict growth. Hofman and Aalbers (2019) found that the real estate and finance sectors contribute more to the UK economy than manufacturing. House price declines, as seen in the subprime crisis (Rapach and Strauss, 2009), can affect financial markets, as shown by the study of Gounopoulos et al. (2012).

Following the asset pricing theory and behavioural finance theory, there exist correlations between investor attention and financial assets prices. Behavioural finance demonstrates that ‘investor attention’ might cause asset prices, including housing prices, to deviate from fundamentals, leading to increased volatility (Ryu et al., 2017, Stambaugh and Yuan, 2017). While investor attention has been shown to have a substantial effect on other financial domains, for example stocks, oil, commodities, and foreign exchange (Choi and Varian, 2012, Da et al., 2011, Swamy et al., 2019, Goddard et al., 2015, Gupta and Banerjee, 2019), its impact on the housing market tends to be underexplored. The traditional asset pricing models assumed that investors pay close and appropriate attention to asset valuation (Da et al., 2011), because new information is instantly reflected in asset prices. In fact, attention is a ‘scarce cognitive resource’ (Kahneman, 1973), and investors’ attention could be limited. Some current research proposed theoretical models in which investors’ attention with inherent limitation might impact both the statics and dynamics of asset price. This could be in stark contrast to the vast amount of financial market information available to the investors (Cao et al., 2021).

Empirical studies have further indicated that investor attention exhibits fluctuations over time, and these fluctuations exert a noteworthy impact on asset prices. When investor attention levels are high, it often leads to increased buying pressures and sudden price reactions (Barber and Odean, 2008, Dash and Maitra, 2022). Conversely, during periods of low attention levels, there is a tendency for an underreaction to announcements (DellaVigna and Pollet, 2009, Ben-Rephael et al., 2017). In fact, previous studies by Huberman and Regev (2001) and Hou et al. (2009) emphasise that prices respond to new information primarily when investors actively direct their attention towards it. Considering these findings, it becomes clear that recognising investor attention is a vital aspect to pursuit in the study of housing prices, especially in the context of the information age.

From the above studies, the link between investor attention and house prices domains has not been clearly investigated. This study thus contributes to important but underexplored fields of economic literature, in particular the limited existing literature on investor attention and house prices. It is one of the original empirical studies on the relationship between house prices and investor attention, specifically its investigation of search engines from property investors' perspectives.

## Measurement of investor attention

When investigating theories of investor attention, researchers would face a formidable challenge in determining how to quantify investor attention. Previous literature has developed a few empirical proxies to measure investor attention. There are two emerging distinct types of proxies: indirect and direct proxies. Each proxy has its own set of benefits and drawbacks.

Some of the previous studies proposed indirect proxies for investor attention in the finance industry. Barber and Odean (2008) used ‘extreme one-day returns’ to investigate the effect of attention and news on investors’ purchasing behaviours. Seasholes and Wu (2007) demonstrated that ‘price limit’ events draw the attention of the investors. Similarly, Gervais et al. (2001) and Hirshleifer et al. (2009) demonstrated that a rise in trading volume enhances the visibility of a stock and attracts greater investors’ attention. Chordia and Swaminathan (2000) claimed that trading volume appears to include information beyond that contained in the company scale in capturing investor attention.

However, there is a limitation to this indirect proxy approach due to the trading volume proxy possibly being influenced by other relevant variables. Chemmanur and Yan (2019) and Grullon et al. (2004) utilised advertising expenses to explore the influence of investor attention on stock returns. Using Friday Earnings Announcements, DellaVigna and Pollet (2009) attempted to address the question of whether investor attention affects stock returns. These proxies adopt the crucial premise that it is necessary for the investors to take notice of a particular stock if it was highly profitable or if it was discussed in the press. However, there are several limitations to this technique, such as return or turnover of a stock can be affected by variables which are not related to investor attention, and the attention of the investor cannot be guaranteed by a newspaper item unless they really read it.

Direct proxies for investor attention were also investigated in the finance industry. Ben-Rephael et al. (2017) supported a direct measurement of investors' attention by analysing activity on reading and searching news for stocks on Bloomberg terminals. Another direct proxy employed by Cao et al. (2021) was utilising and using the data from the Securities and Exchange Commission’s EDGAR (Electronic Data Gathering, Analysis, and Retrieval) log files to study the link between the divergence of opinions and future stock returns. Similar to Cao et al. (2021), Gao et al. (2020) and Li et al. (2019) assessed the investor attention using EDGAR website user activity. Besides that, Da et al. (2011) and Drake et al. (2012) suggested using `Google's Search Volume Index` (GSVI), a publicly available tool Google provides via Google Trends, as a tool for quantifying investor attention.  These authors argued that the GSVI is more appropriate for measuring the attention of individual and retail investors. The findings of this research demonstrated a strong positive correlation between changes in search volume and investor trading.

In this research, the GSVI is employed as a direct measurement of investor attention. Our choice of this Google trend index is driven by its considerable use in the behavioural finance literature as a measurement proxy for investor attention (Goddard et al., 2015, Da et al., 2011, Drake et al., 2012). Additionally, the recent prominence of the Fear of Missing Out (FoMO) concept which plays a key role in behavioural finance literature (McGivern, 2023, Gerrans et al., 2023, Argan et al., 2023), has significantly influence the dynamics of house prices. Individuals driven by FOMO tend to intensify their online searches for real estate information, seeking to capitalize on perceived market trends and seize opportunities before prices surge further. Especially, in the wake of the COVID-19 pandemic and the subsequent surge in remote work and social isolation, the housing market experienced a notable transformation. During the pandemic and post-pandemic periods, as people were confined to their homes and increasingly relied on online tools, there was a pronounced trend of heightened online search activity related to house prices and the housing market. Google has become one of most universal search engines for investors to collect information, particularly in Australia. Furthermore, and possibly more important, searches can assist people in avoiding issues from indirect proxies, such as psychological obstacles or news and headlines (Barber and Odean, 2008, Aggarwal and Lucey, 2007). Lastly, GSVI offers a useful indicator for gathering publicly accessible information from a variety of sources, giving the investor access to a highly diversified set of information.

# Data and methods

Since our goal is to investigate the correlation between investor attention and house prices, the data set will contain two main variables: investor attention and house prices.

The House Price Index data are collected from the FRED database (Bank for International Settlements, 2023) using the ‘fredr’ package in R with series ID = ‘QAUR628BIS’. This comprehensive collection of nominal residential property price data comprises over 300 datasets from 61 countries, sourced from national central banks. These data series exhibit significant variations across countries, differing in terms of frequency. In the context of our study, the data for Australia is available on a quarterly basis. The line chart presented in **Figure 1** visualises this chronological data series.

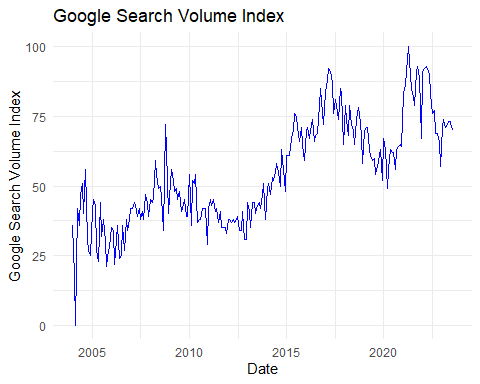
Figure 1: Australian House price over time

A graph showing the price of a house

Description automatically generated

In this study focusing on the correlation between Google search data and housing prices, the keywords are proposed primarily adapted to the studies by Wu and Brynjolfsson (2015), Beracha and Wintoki (2013), McLaren and Shanbhogue (2011) and Pham and Huynh (2020). Google Trends provides a platform for users to access a query index associated with specific phrases, such as ‘Housing price’. To gauge investor attention in purchasing real estate properties, we incorporated three primary keywords ‘House price’, ‘Property price’, and ‘Real estate price’ to capture investor attention in the housing market. However, as these keywords might encompass a wide range of queries, we took steps to refine these keywords within the predefined ‘Real estate’ category in Google Trends, which encompasses queries related to real estate with aiming to better attract investors searching for property. While we acknowledge the potential for noise in the data due to the inherent limitations of online searches, we diligently minimized this possibility to the best of our knowledge. Keywords are refined based on location, in this case Australia, and a time span ranging from January 1, 2004, to August 8, 2023, using the website channel, focusing on the 'Real Estate' category, and is presented on a monthly basis. The data was normalized on a scale from 0 to 100. In this scale, 0 represents minimal search activity, while 100 indicates the highest level of search activity for a particular keyword or phrase. It's important to note that the trend for these keywords can change over time as new maximum search activity levels are reached. The aggregation of data and the scaling process may introduce a potential for data loss. However, if the data is standardised again from the absolute values when considering it for a fixed period, any resulting data loss is deemed trivial. The line chart presented in **Figure 2** visualises this chronological data series.

Figure 2: Google Search Volume Index over time



Before advancing to the subsequent stages of analysis, the House Price Index data is transformed into an interval scale ranging from 0 to 100. This transformation ensures a harmonised scale in line with the Google Search Volume Index (GSVI) data. Additionally, to ensure synchronisation in frequency, the GSVI data, initially collected monthly, is converted to quarterly intervals. The final dataset comprises GSVI and House Price Index data, both with a quarterly frequency, spanning from 2004 Q1 to 2023 Q1. To visually explore the relationship between these two datasets, scatter plots and line plots will be generated.

Subsequently, a cross-correlation analysis will be conducted to assess the correlation between the datasets. This analysis will be performed using R version 4.2.2. Strong correlation will be defined as a correlation coefficient value of 0.7 or higher. The cross-correlation function (CCF) will provide insights into the strength and direction of the cross-correlation between the two time series variables: Google Search Volume Index and House Price Index.

The CCF will be calculated at various lags, allowing us to observe how the correlation between the two variables changes as the lag increases or decreases. This information will help us understand any potential time-based relationships between Google Search Volume Index and House Price Index.

# Results and discussion

Based on **Figure 3**, the scatter plot created from the given datasets of Google Search Volume Index and House Price Index, it is evident that there might be a high correlation between these two variables. The scatter plot visually shows a trend where, as the Google Search Volume Index increases, the House Price Index tends to rise as well. The data points are not randomly scattered but rather form a somewhat linear pattern that suggests a positive relationship between the two variables.

Figure 3: Scatter plot: House Price Index vs Investor Attention

A graph of blue dots

Description automatically generated

Furthermore, the line chart (**Figure 4**) reinforces this observation, as a line of best fit drawn through the data points shows an upward trend, indicating a potential positive correlation. This line provides a clear representation of how changes in Google Search Volume Index correspond to changes in the House Price Index over time.

Figure 4: Line Plot: Investor Attention vs House Price Index

A line graph showing the price of a house

Description automatically generated

The above observation is confirmed by cross-correlation result. Regarding to **Table 1**, it becomes evident that there is a strong and consistent correlation between the two variables, Google Search Volume Index and House Price Index. There is a noticeable positive correlation between the two variables. Positive values indicate a positive correlation, meaning that as one variable increases, the other tends to increase as well, and vice versa.

The positive correlation values observed at various lags suggest a relationship between the two variables that spans across different time shifts. The highest positive correlation is observed at a lag of 0, where the CCF value is 0.911. This suggests a strong positive correlation between the current values of the two variables. The decreasing trend in correlation values as the lag increases indicates that the strength of the correlation tends to decrease as the time gap between the two variables widens. This is expected since correlations between distant observations may become weaker due to the influence of other factors and variables that come into play over time.

Given the high significance levels indicated (*p ≤ 0.01)* across all lags, it is reasonable to conclude that the correlation observed is statistically significant and not likely to occur by chance. This strengthens the evidence for a meaningful relationship between Google Search Volume Index and House Price Index.

Table 1: Cross-Correlation Function Result

|  |  |
| --- | --- |
| **Cross-Correlation Function Result** | |
| **Lag** | **Correlation** |
| 0 | 0.911 |
| -1 | 0.898 |
| -2 | 0.872 |
| -3 | 0.827 |
| -4 | 0.764 |
| -5 | 0.690 |
| -6 | 0.619 |
| -7 | 0.554 |
| -8 | 0.493 |

Overall, the provided CCF results suggest a significant positive cross-correlation between the Google Search Volume Index and the House Price Index, with a strong immediate correlation (0.911) and a moderately positive correlation even at longer lags. This could indicate that changes in Investor Attention are associated with changes in the House Price Index, either in the short term or over a longer time horizon. The notable immediate correlation which is observed at the 0-lag point is likely since we used quarterly data, making it harder to capture subtle variations in the ongoing dynamics. This immediate effect we refer to is within the context of a three-month timeframe.

The scatter plot at a lag of 5 aligns with the positive correlations seen in the CCF result is illustrated in **Figure 5**. The plot visually confirms that higher Google Search Volume Index values at an earlier time point tend to correspond with higher House Price Index values 5 time steps later. This consistent pattern lends further support to the observed correlation and suggests a potential predictive relationship between the two variables.

Figure 5: Lagged Relationship between Google Search Volume and House Price Index

A graph of a number of houses

Description automatically generated with medium confidence

In relation to previous studies that have explored the relationship between housing prices and economic indicators, our findings provide an intriguing addition to the existing literature. Prior research has primarily focused on macroeconomic factors like unemployment rates, economic growth, and inflation as drivers of housing price dynamics. Our analysis introduces a different perspective by examining the relationship between housing prices and investor attention, a factor that has been relatively understudied in the housing market context. While previous studies have established correlations between housing prices and primary economic indicators, this paper introduces the notion that investor attention might also play a significant role in influencing housing prices. Behavioural finance theory suggests that attention scarcity among investors can lead to deviations of asset prices, including housing prices, from their fundamental values. This aligns with the findings of our analysis, as we have demonstrated a correlation between Google Search Volume Index (a proxy for investor attention) and House Price Index.

In this way, the results find support in the context of behavioural finance theory. The positive correlations between Google Search Volume Index and House Price Index, particularly across multiple lags, provide empirical evidence that investor attention could indeed correlate with housing prices. This supports the idea that investor attention is not only relevant in other financial domains but also in the housing market, shedding light on a potentially overlooked determinant of housing price dynamics.

# Robustness test

To assess the quality and reliability of our findings, we conducted robustness testing using different version of a key variable – the Australian House Price Index. We sourced the data from the Australian Bureau of Statistics report titled ‘Residential Property Price Indexes: Eight Capital Cities’ (Australian Bureau of Statistics, 2022). Specifically, we utilised the data concerning the Weighted Average of Eight Capital Cities from this dataset, considering it as a representative indicator of Australian house prices. This data is identified by Series ID: A83728455L and covers the period from September 2003 to December 2021, with a quarterly frequency.

After transforming the data into a consistent interval scale ranging from 0 to 100 and accounting for data availability, our sample for this robustness test covers the period from the first quarter of 2004 (2004 Q1) to the fourth quarter of 2021 (2021 Q4). The outcomes of this analysis further reinforce the conclusions drawn from our initial findings. The familiar pattern of a positive correlation between the variables is reaffirmed, as clearly presented in **Table 2**. The correlation between the Google Search Volume Index and the House Price Index remains consistently strong across various lags, mirroring the results of our previous analysis.

The consistent positive correlation values observed across different time shifts indicate a persistent relationship between the two variables. The highest positive correlation occurs at a lag of 0, where the CCF value is 0.884. Although there might be slight variations, this still signifies a robust and strong positive correlation between the current values of the Google Search Volume Index and the House Price Index. As the lag increases, the correlation tends to decrease, which is in line with our earlier observations.

The fact that the correlation remains statistically significant, as indicated by the significance levels *p ≤ 0.01* across various lags, adds further credibility to our findings. These robustness test results emphasise the stability and consistency of the observed correlation between Google Search Volume and House Price Index, enhancing the validity of our initial analysis.

Table 2: Cross-Correlation Function Result (Robustness Test)

|  |  |
| --- | --- |
| **Cross-Correlation Function Result** | |
| **Lag** | **Correlation** |
| 0 | 0.884 |
| -1 | 0.848 |
| -2 | 0.799 |
| -3 | 0.723 |
| -4 | 0.652 |
| -5 | 0.619 |
| -6 | 0.592 |
| -7 | 0.563 |
| -8 | 0.538 |

# Conclusion

This research has delved into the correlation between investor attention and house prices within the context of the Australian housing market. Through an empirical analysis using Google Search Volume Index as a proxy for investor attention and the House Price Index as a measure of house prices, we have uncovered meaningful insights into the correlation between these two variables.

Our investigation revealed a strong and consistent positive correlation between investor attention and house prices in Australia. This finding supports the notion that investor attention is a significant factor in influencing short-term fluctuations and potentially long-term trends in the housing market. The correlation suggests that changes in investor attention, as manifested through increased Google search activity related to housing prices, tend to coincide with changes in house prices. This association may be indicative of a feedback loop, where shifts in investor attention impact housing demand, subsequently affecting housing prices. This can be supported by supply and demand theory. The results of this study also align with the principles of behavioural finance, highlighting the relevance of investor attention in asset pricing theory, including the housing market. The positive correlations observed between GSVI and the House Price Index at various lags underscore the potential predictive nature of investor attention in the housing market. These findings contribute to the growing body of knowledge that highlight the importance of behavioural factors in shaping financial market dynamics.

Furthermore, our research contributes to the existing literature by providing empirical evidence of the relation between investor attention and the housing market, a field that has been relatively understudied compared to other financial domains. By employing Google Search Volume data, we offer a novel perspective on investor sentiment and preferences, shedding light on the dynamic relationship between investor behaviour and housing price trends in Australia.

Our paper has several implications. Investors, policymakers, and market participants can benefit from understanding the impact of investor attention on housing prices. By acknowledging the role of investor attention, stakeholders can make more informed decisions and develop strategies to navigate the ever-changing landscape of the housing market. This research also fills a crucial gap in the literature by shedding light on the correlation between investor attention and the housing market, particularly in the Australian context. The empirical evidence presented offers valuable insights into the dynamics of housing prices and contributes to the broader understanding of how behavioural factors influence financial markets. As the housing market continues to be a pivotal economic and societal component, recognising the role of investor attention can assist in promoting informed decision-making and fostering a more resilient and sustainable market.

There are several limitations to this study that needs consideration. The sample's quarterly frequency could potentially hinder the detection of subtle changes in the relationship we are investigating. This limitation arises from the fact that with fewer data points in a given period, it becomes more challenging to capture the detailed variations in the dynamic under investigation. To mitigate this constraint, future research might explore the integration of higher-frequency data, such as monthly data, allowing for a more detailed and accurate analysis of the relationship between investor attention and house prices. In addition, establishing upon the observed correlation between investor attention and house prices, there exists the potential to extend our analysis. By employing regression and prediction techniques, we can delve deeper into the relationship, thereby gaining a more nuanced understanding of the ways in which investor attention influences housing prices. This path of investigation offers the potential to reveal insights into predicting outcomes and providing a clearer understanding of the factors that influence the connection between these variables. Furthermore, in terms of future research directions, it could be valuable to incorporate primary economic indicators. This inclusion would facilitate a comparison of the impact of investor attention on house prices relative to other established economic markers. By broadening the scope in this manner, we can gain a more comprehensive understanding of the influence exerted by investor attention within the larger economic context.

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