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Beyond luck: The key to profitable residential real estate investments for individual investors in Türkiye

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Abstract

Individual residential investors are influenced by the media and their environment in their investment preferences, as they lack the experience of property investors and professional residential investors. Concerns about regret, fears of further property price rises and social circumstances put pressure on investors. Under these conditions, are individual housing investors seeing all the opportunities in the housing market? What types of buyers are taking advantage of these opportunities? This study aims to create tools to help individual residential investors identify opportunity periods in the market, analyse such opportunities retrospectively and test consumer behaviours in response to these opportunities. We analysed the opportunity for access to housing, the opportunity of lower loan interest rates and the opportunity of lower housing prices in Türkiye in the 120 months between 2013 and 2022 using the income-housing price scale. We analysed residential sales (total, credit and cash) in the opportunity periods resulting from the equations set up for the opportunity periods. We tested the criteria for selecting opportunity periods using the analysis of variation (ANOVA) method. We analysed changes in consumer preferences for credit and cash home purchases during periods of opportunity. We found that residential investors did not use the opportunity of accessing residential properties, and that cash home buyers used the opportunities of residential loan interest rates and residential price declines.

Keywords: home, housing, investment, profit, real estate.

1. Introduction

Türkiye's monetary policy, high inflation, urban redevelopment and earthquakes have recently kept demand for residential property buoyant. In Türkiye, 1.5 million houses are sold yearly (TUIK, 2023a). There are 26 million households in Türkiye (TUIK, 2023b), and 26 per cent of them are tenants (TUIK, 2023c), and every household is a potential homebuyer. Unless individual investors are professionally involved in residential investment, they make purchasing decisions under the influence of their immediate environment and the media.

Investing in residential property can be a lucrative opportunity for individual investors, but success in this area requires more than luck. Identifying profitable opportunities in the market requires know-how, experience and a strategic approach. The residential property market has always been an attractive investment option for individual investors. Unlike other investment tools, such as shares or bonds, residential property is a tangible asset that can provide stable income streams and long-term capital growth. However, investing in residential property is not without its challenges. It requires a clear understanding of market trends, and the ability to identify opportunities and make sound investment decisions. Furthermore, individual investors have to decide between complex market conditions such as fluctuating interest rates, residential property prices and economic trends, which makes investing in residential property even more challenging.

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This research paper explores the essential factors distinguishing successful residential property investors from those struggling to make a profit. To help individual investors maximise their returns from residential property investments, we will analyse the opportunities available in the residential property market, how to quantify them, and which buyers have made the most of them over the past ten years. This article details effective investment approaches and provides a guide for individual investors looking to benefit from the opportunities in the residential property market.

There are few studies in the literature on the opportunities for investment in the residential sector in Türkiye and the analysis of these opportunities. This article aims to fill that gap. The other parts of this paper firstly present housing and its importance for households, the decision to buy residential property, residential investors and their types, the impact of residential property prices on investors, affordability and its scales, residential property price changes and their consequences in developed and developing countries, the rationality of residential property investors, media and environmental effects in residential property investment, psychological factors in residential property investment, market data in the housing market and analyses of market information. The study's methodology and the analysis stages are then presented. In the following section, the statistics and results of housing accessibility opportunity, housing affordability opportunity and housing price opportunity are presented. The discussion and conclusion share the study's results, limitations and suggestions for future studies.

2. Literature Review:

Residential property is used for consumption and investment (Henderson & Ioannides, 1983). It also accounts for the largest single household expenditure (Ben-Shahar & Warszawski, 2016). The motivations of residential property buyers are to own a dwelling, earn rental income and benefit from the increase in value (Erdoğdu & Büyükduman, 2018).

Residential decisions are complex, involving economic and social motives, and cannot be ranked (Lux et al., 2017). Homeownership indicates people's personalities and lifestyles (Koklic & Vida, 2014). In Triantafyllopoulos and Kandyla's (2010) study, 8% of homebuyers cited homeownership as a way to escape renting, enjoy better accommodation, and leave a legacy for the next generation. Wealth accumulation and long-term capital gains were the most important considerations when investing in property. Wealth accumulation and long-term capital gains were the most important considerations when investing in property (De Bruin & Flint-Hartle, 2003).

2.1. Housing Market Investor Types

Bayer et al. (2020) observe two individual residential property investor types. One is the middleman, and the other is the speculator. Middlemen are always in the market, buying below the market price and selling above the market price. On the other hand, speculators usually enter the market during the boom and buy and sell at the market price. Some amateur speculators enter the residential market during a boom. People may have experience because they buy some products frequently. However, in the case of expensive and complex products, learning based on trial and error is rare (Bazerman, 2001). Gaining experience in the property market based on trial and error can be costly for many people.

Investors can have different impacts on the housing market. Individuals' entry into the housing market as investors increase by 20% if they have recently moved or if their neighbour has started investing in property (Bayer, et al., 2016). Chen et al. (2021) provide evidence of speculators' impact on feedback or momentum trading in the housing market. They found that short-term speculators contribute to price overreactions in shallow markets with limited price information. Market conditions can also influence investors. When price trends are strong, there is little disagreement among investors, but when there is ambiguity, not surprisingly, investors seem to have a much less clear picture (Case, et al., 2012).

Real property investors have a professional investment approach, distinguishing them from residential investors. D'Lima and Schultz (2021) state that property investors are only interested in

the property's investment potential. On the other hand, property investors may be motivated to invest by the opportunities that the property offers.

2.2. Access to Residential Properties

For residential property purchases, personal income and loans are typically combined, with loan leverage up to four times higher in some cases (Alexiou, et al., 2019). The reason for such a high borrowing burden is that housing costs account for a significant share of household income spent. Newman (2010) suggests that housing costs are 'affordable' if they are less than 30-40 per cent of household income. Yates et al. (2007) have introduced a different perspective on housing affordability concerning household income: After subtracting housing costs from household income, a total residual income should be acceptable to the household.

Different scales are needed to implement housing and social policies. In the US, the area median income (AMI) is used to measure who needs affordable homeownership and who does not (Newman, 2010). Another scale used in many countries is the income-housing price multiplier. This scale, used to represent the motivation or interest of the homebuyer to purchase, is the most common (André, et al., 2014). This scale also measures regional and household differences (Hulchanski, 1995). In developed economies: such as Australia, Canada, Ireland, New Zealand, the United Kingdom and the United States, median house prices were generally 2-3 times median household incomes (Demographia, 2012).

There are also opposing views on the definition of the price-income scale and the limitations of its use. Jewkes and Delgadillo (2010) argue that revisions to the scale mean that it cannot be easily applied to individual households. Robinson, et al., (2006) argue that an inherent problem arises from the lack of a specific definition of 'affordability'. Sliogeris et al. (2008) suggest many technical and conceptual scale problems. He notes that the main problem is that incomes and costs change over time, and that, generally, a larger proportion of income is spent on buying property at an earlier age, and a smaller proportion at an older age.

Although objections exist to the definitions, expressions, multipliers and scales used for housing affordability, analysts must simplify approaches and take averages. Comparisons over short periods are much more accurate than over long periods (Paris, 2007).

2.3. Residential Property Price Changes, Emerging Economies and Bubble Effects

The rise and fall of the residential market during the past decade are one of the most important events in modern economic history (Case, et al., 2012). These falls and rises in the residential market attract investors' attention and whet their appetite. Looking at the relationship between incomes and residential prices, the rise in residential prices has been higher than the rise in incomes since 1998 (Shiller, 2015).

Türkiye has long been considered an emerging market. Many property market reports also list it as an 'emerging market'. For this reason, looking specifically at residential property markets and price changes in emerging/emerging market countries will be helpful. Cesa-Bianchi, et al., (2015) analysed residential price changes in advanced and emerging economies and found that residential prices grew faster and were less volatile in advanced economies. However, the global liquidity shock's impact on residential prices and residential consumption is more pronounced in emerging economies than in advanced economies. Coşkun (2016b) notes that there is a traditional demand for residential property due to the increase in demand in the residential market in Türkiye and the increase in prices in recent years, related to the fact that residential property is seen as an investment instrument.

Over the past two decades, Türkiye has experienced rapid urban growth. This change has also attracted the attention of housing investors. In booming cities, residential buyers have higher expectations about future house price increases, and their investment motives are more affected (Case & Shiller, 1988). Many studies have been conducted on residential property price changes. In these studies, residential property prices have been correlated with many variables. Interest rates

on loans and residential property prices are the most prominent among these comparisons. Interest rate is one of the most effective factors on house prices. High-interest rates reduce house prices in the short term (Lorig & Suaysom, 2022). Other research has focused on macroeconomic variables. Case and Shiller (1988) argue that house price booms occurred in well-defined geographical areas, while prices did not rise in most countries, suggesting that macro variables provide only a partial explanation. Good urban design, more integrated urban space and increased exercise add value by increasing property values. (Topçu, et al., 2007).

2.4. Rationality of Investors in the Residential Market

Traditional economic theory postulates an "economic man" who, in the process of being "economic", is also "rational". This rational man is assumed to have a knowledge of the relevant aspects of his environment which, if not absolutely complete, is at least impressively clear and comprehensive (Simon, 1955). Rational investors seek to estimate future income changes best when making investment decisions (Holtemöller & Schulz, 2010). Property decision-making is a rational process that uses real data and leads to an optimal decision (Gallimore & Gray, 2002).

Are individual residential investors able to make rational residential investment decisions? De Bruin and Flint-Hartle (2003) observed that rental property investors made decisions based on incomplete information and limited region-specific and cognitive computational power. This approach makes it difficult to achieve the best in an ever-changing and complex property market. Shiller (2015) comments that people rarely remember the prices of the residential properties they bought at the time of purchase and are surprised by the difference by comparing them with today's prices.

The importance of personal experience in residential property investment was also highlighted in Gallimore and Gray (2002). In the survey of relatively experienced property investors, price rated first (6.28/7.00), personal feelings based on experience rated second (5.89/7.00), interest rates rated third (5.70/7.00), and supply/demand statistics rated fourth (5.59/7.00). Notably, personal feelings based on experience rated second for non-ordinary, relatively experienced residential investors.

De Bruin and Flint-Hartle (2003) observed that residential investors did not conduct any risk analysis or use any techniques and criteria in their residential investments with the "low-risk investment" preference. Unable to cope with the complexity of risk assessment, investors relied on intuitive risk assessments. Similar results were observed by Lux et al. (2017). In a survey of 57 respondents, not a single respondent considered the expected increase in house prices, and 47 respondents did not make any financial comparisons. The reasons given by the respondents for buying a property were uninformed and unsupported by facts: security of tenure, the freedom to furnish their homes as they wish, and the fact that housing offers greater security of savings than other types of investment. Individual sentiment has been found to distract investors from making the right decisions. During the property bubble, amateur speculators acted at the peak of residential prices, expecting prices to continue to rise (Bayer et al., 2016). Shiller (2015) argues that the changing behaviour of residential property prices indicates that the public's interest in speculative price movements has increased.

Residential investment can easily become the subject of many conversations between individuals. In these conversations, parties can naturally influence each other. It was observed that residential investors lacked basic knowledge and tended to interpret events through hearsay, stereotypes and ordinary observations (Case & Shiller, 1988).

There are also studies in the literature that support the view that investors act rationally. D'Lima and Schultz (2021) find that property investors' returns are sensitive to the index and more sensitive to the upward direction. They relate this result to the timing ability of property investors. Case, Shiller and Thompson (2012) argue that home buyers are mainly aware of price trends in the market, especially at the time of purchase. Speculators may not be unreasonable to buy more

frequently as residential property prices rise, as some have achieved reasonable returns (Bayer et al., 2020).

2.5. Media and Immediate Neighbourhood Influence on Residential Investment

Media interest in property markets was relatively low until the 20th century. Today, the media strive to attract public attention to survive and constantly compete with each other (Shiller, 2015). As a result of this competition, attention-grabbing or exaggerated news can sometimes be reported. According to the mental frames theory of cognitive psychology, people tend to be influenced by their mental frames and act in the same way as their family and friends. Moreover, it has been observed that individuals tend to synchronise their frames with those of their friends, family and others with whom they are in contact (De Bondt, 1998).

Do mainstream media and interpersonal dialogue influence residential investors? Information and opinions conveyed by mainstream media have less influence than interpersonal dialogue (Shiller, 1995; Chang, et al., 1999). Tarde (1901) argues that opinions are formed through conversations between individuals and their newspapers and refined through conversations with other people in coffee shops, thus forming public opinion. Katz (2006) puts forward a different idea: the media influence individuals, but it is an "indirect influence".

According to opinions gathered through the media or individuals, people believe it will be more challenging to buy a property in the future, with a significant percentage of pessimistic people rushing to buy a house (Triantafyllopoulos & Kandyla, 2010).

2.6. The Psychology and Stress of Buying a Residential Property

Internal and external pressures can affect the duration and quality of residential investment decisions. Changes in residential property prices, social factors and housing conditions are some of the things that influence individuals. Price changes put pressure on homebuyers. It has been observed that 2/3 of homebuyers have felt pressure to buy due to price changes (Triantafyllopoulos & Kandyla, 2010). Another effect of the change in residential property prices is that homebuyers are worried that they will no longer be able to afford a residential property due to the increase in property prices and that they will not be able to buy a property again. Because of this fear, homebuyers are quick to make offers on residential properties (Shiller, 2015). Homebuyers also experience worries and regrets. Anxiety is often associated with access to homeownership or first-time homeownership by young households (Richards, 2008). Regret can occur when individual investors do not make the right decision. As a precaution against regret, investors believe that by choosing to act in line with the actions of others, they reduce the likelihood of regret (Shiller, 1995; Beltratti, 2004). It can be argued that the reverse is also true for the pressure residential property exerts on individuals. When people are optimistic about the market, house prices rise, but forces are set to bring them down (Shiller, 2015).

2.7. Residential Market Data and Expertise

Some of the data in the residential market can be measured in the markets. To what extent is it possible to measure the residential market with this data that real estate professionals pay more attention to? Shiller (2015), in his research on house price forecasting models, states that half of the variability in house prices can be predicted about a year in advance. He states that the other half, which cannot be predicted due to increased market volatility, has a considerable share.

Research on the market knowledge of individual residential property investors shows that individuals are more knowledgeable about the environment in which they live and have higher hit rates in terms of profits. New entrants to residential property investment pay more for a property and earn less (Bayer et al., 2016). Investors outperform market indices if they live close to the property they invest in, do not use credit (buy cash) and have experience in property investment. In contrast, investors make less profit from the properties they live in compared to other properties (D'Lima & Schultz, 2021). For most people, it is not easy to adjust the timing of their residential property purchase by taking advantage of trends (Shiller, 2015). Coşkun (2016a) mentions that

increasing housing consumer literacy could improve residential demand/ownership/financing by supporting consumers' rational decision-making.

The literature suggests that residential investors follow their instincts rather than apply risk analysis and financial approaches to their investment decisions. As individuals are influenced by each other and the media, housing investors may be in a hurry and under pressure. On the other hand, unlike financial markets such as the stock exchange, where technical analysis can be carried out, the tools available to residential investors are inadequate. While residential investors make low profits on their properties, they can make higher profits on the properties they buy for investment purposes. Residential investors can be more successful with residential investments close to where they live. Residential investors have the most control over house prices when they buy their properties. The research results show that the success rates of residential investors increase when they closely follow the market and are familiar with the data. Individual investors' success can increase under certain conditions in the region they know.

Despite the potential for lucrative returns, individual investors often struggle to succeed in the residential property market due to a lack of market monitoring, experience and knowledge. These raise the question of whether individual investors are missing out on profitable opportunities and whether their decision-making in the residential property market is rational. In addition, there is a need to identify the key factors differentiating successful property investors from those who struggle to inform potential investors of the best practices for successful residential property investment. Many individual investors in the residential property market struggle to make a profit due to a lack of knowledge and experience in identifying and taking advantage of profitable investment opportunities. Our research questions:

- Can individual house investors identify opportunities in the residential property market?
- Can individual investors see all opportunities in the residential property market?
- What type of buyers seize the opportunities?
- What is the role of opportunity periods in the residential market on the behaviour of consumers?

Objectives:

- To test the ability of individual residential investors to identify periods of opportunity in the market using the scales created.
- To analyse the sales of residential property (total, credit and cash) in the period resulting from the equations set up for the opportunity periods and to test the effects of the choice of opportunity periods.
- To analyse the behaviour of credit and cash residential buyers in opportunity periods.
- Analysing residential affordability, loan interest, and price affordability opportunities by income residential price scale over 2013-2022 in Türkiye.

3. Methodology

In this study, we used publicly available databases for 2013-2022. We used some of the data obtained from these databases as they are and edited the data by correcting some of them. The sources, source names and source abbreviations listed in Table 1 are used in the article. The data listed as authors under the source title in the table are listed as edited data.

Table 1 Sources, data and abbreviations

Source	Subtitle	Abbreviation
TUIK, Authors	Adjusted Home Sales	AHP
TUIK, Authors	Adjusted Mortgage Sales	AMS
TUIK, Authors	Adjusted Cash Sales	ACS
TUIK	Consumer Price Index	CPI

TUIK	Inflation	-
CBRT	Real Home Price Index	Real HPI
CBRT	Mortgage Interest Rates	MIR
CBRT	Interest Rates for Deposits	IRD
CSGB	Minimum Wage	-
Authors	Minimum Wage House Price Ratio	MWHPR
Authors	Housing Minimum Wage Scale	HoMiWaS
Authors	Housing Minimum Wage Scale Opportunity	HoMiWaSOpp
Authors	Loan Interest Advantage	LIA
Authors	Loan Interest Advantage Deposit	LIAD
Authors	Loan Interest Advantage Inflation	LIAI
Authors	Cheap Housing Opportunity	CHO

TUIK: Turkish Statistical Institute, TURKSTAT
CBRT: Central Bank of the Republic of Türkiye
CSGB: Ministry of Labour and Social Security of the Republic of Türkiye

In the research, we analysed data on residential property sales (TUIK, 2023a) under three headings: total sales, mortgaged (loan) sales and cash sales. We did not use these sales as raw data. The reason was that there were public and religious holidays in each month, which created a seasonality effect, so we averaged the sales per working day for each month according to the working days in each month. We took each month (which we call the period in the research) to be 30 days and assumed there were 21 working days each month. In a year, there are about 20.7 working days in each month. For ease of calculation, we set the number of working days to 21 so that all periods were comparable. To make this adjustment understandable, we have added the word 'adjusted' at the beginning of the data on sales of residential buildings.

Adjusted Sales (Total, Cash, Mortgage) = [Sales (Total, Cash, Mortgage)] / (Period Working Day* 21)

The inflation rate was calculated from the consumer price index (CPI) published monthly by TURKSTAT and compared with the same month of the previous year.

We did not use the residential loan rate announced by the banks. In order to eliminate the cases where some banks do not prefer to lend housing loans even though the interest rate seems low, we used the residential loan interest rate based on the data of the housing loans used. The interest rate announced weekly by CBRT (2023b) is called the weighted residential loan interest rate. This data, which we receive on a monthly basis, was used in our study as the monthly housing loan interest rate.

Minimum wage data are usually published annually but may be published more than once a year during periods of high inflation. The minimum wage data were taken from the Ministry of Labour and Social Security of the Republic of Türkiye (TCSG, 2023).

In calculating the minimum wage to residential price ratio (MWHPR), Türkiye's average residential size (m^2) can be tracked using monthly building permits or occupancy permits. The average residential size in Türkiye is 120 m^2 in 2021, according to building permits (TUIK, 2023d), and 115 m^2 in 2021, according to occupancy permits (TUIK, 2023d). The difficulty of changing these data every month was overcome by accepting an average size of 100 m^2 for residential properties. For each period, the residential price was obtained by multiplying the residential unit price announced by the CBRT (CBRT, 2023a). This dwelling price was divided by the minimum wage in that period to obtain the MWHPR.

MWHPR = [(Average Residential Size * Average Residential Unit Price) / Minimum Wage]

Our research looked at the periods that might be advantageous for residential investors regarding the timing of residential purchases. Unfortunately, the option that the price of the property purchased lower than the market average could not be included in the scope of our study due to the lack of actual sales data. Of the remaining headings, we thought it might be useful to focus on three, given the availability of adequate data, the fact that they could be produced on an

ongoing basis from the data made available to the public, and the advantage of continuing to measure them at the time of the survey. These headings are;

- Opportunity to access residential property by minimum wage and average residential price (HoMiWaSOpp)
- Opportunity to access residential property according to mortgage interest rate advantage (LIA, LIAD, LIAI)
- Opportunity to invest in residential property according to the decline in real residential property prices (CHO)

Residential Accessibility Opportunity (HoMiWaSOpp): The "minimum wage", the income indicator of the lower income group in Türkiye, is announced by the government every year. We calculated the housing minimum wage scale (HoMiWaS), the number of minimum wages needed to buy an average 100 m² house in Türkiye. In this study, periods identified as lower than the 12-month moving average HoMiWaS value were accepted as opportunities (HoMiWaSOpp). We analysed residential purchases in periods with HoMiWaSOpp regarding loans, cash and total residential sales. MMP: minimum wage residential price multiplier, P: average residential price, M: monthly minimum wage.

$$MMP = P / M$$

$$HoMiWaS = MMP\ 12\text{-}Month\ Moving\ Average$$

$$HoMiWaSOpp = MMP < HoMiWaS$$

Residential loan interest rate opportunity (LIA, LIAD, LIAI): A decrease in the residential loan interest rate increases the use of residential loans, while an increase in the residential loan interest rate decreases the use of residential loans. We analysed residential loan interest rates in three stages:

- The residential loan interest rate lower than the weighted average of the last 12 months was labelled LIA, and the mortgage was accepted as a cheap opportunity.
- The residential loan interest rate lower than the deposit interest rate was labelled as LIAD and the residential loan interest was accepted as a cheap opportunity compared to the deposit.
- The residential loan interest rate lower than the inflation rate was labelled as LIAI, and the residential loan was accepted as a cheap opportunity compared to inflation.

In order for the residential loan to constitute an interest rate opportunity, the difference between the residential loan rate and the deposit rate was expected to be negative. Periods, when the residential loan rate was lower than the deposit rate were considered LIA (loan interest advantage) periods.

To calculate past periods, we compared the previous year's or month's residential loan interest rates. We also compared residential loan interest rates with deposit interest rates and inflation data for 2013-2022. We considered that comparisons with the previous year would not be significant for housing consumers; if the monthly housing loan interest rate was lower than the moving average of the last 12 months' housing loan interest rates, we considered this as a residential loan interest rate opportunity.

In order for a residential loan opportunity (LIA) to occur, the residential loan interest rate at the time of the evaluation must be lower than the moving average of the last 12-month residential loan interest rate. Here, the LIA expression indicates the condition "Mortgage Loan Interest Rate < 12-Month Moving Average (Mortgage Loan Interest Rates)". If this condition is met, the LIA value will be "1"; otherwise, it will be "0".

LIA = Residential Loan Interest Rate < 12-Month Moving Average (Residential Loan Interest Rate)

In the residential loan opportunity deposit (LIAD) calculation, LIAD occurs when the residential loan interest rates are lower than the deposit interest rates offered by banks to their customers. Here, if the quotient of the residential loan interest rate and the deposit interest rate is less than 1, the LIAD condition is met. In other words, the housing loan interest rate must be lower than the deposit interest rate.

LIAD = (Residential Loan Interest Rate / Deposit Interest Rate) < 1

In the residential loan opportunity inflation (LIAI) calculation, LIAI occurs when the interest rate on the residential loan is lower than the inflation rate. Here, if the ratio of the residential loan interest rate and the inflation rate is less than 1, the LIAI condition is met. In other words, the residential loan interest rate must be lower than the inflation rate.

LIAI = (Residential Loan Interest Rate / Inflation) < 1

Chance of a real residential property price decline (CHO) when monitoring the real change in residential property prices, periods of price increases and decreases can be observed. To measure this, we analysed the correlation between the year-on-year real change in the CBRT's residential property price index-HPI (CBRT, 2023b) and residential property sales. Periods, when the PPI declined in real terms were labelled as CHO periods when residential property price was relatively lower (Cheap Residential Opportunity-CHO).

The RPI, which shows quality-adjusted price changes for dwelling units, is calculated by estimating the regression coefficients separately for all periods and strata using the following log-linear regression model (HPI, 2022).

$$lnp_n^t = \beta_0^t + \sum_k \beta_k^t z_{nk}^t + \varepsilon_n^t, \qquad \forall n, t$$

p_n^t : value of residential property n in month t

z_{nk}^t: value of feature k of residential property n in month t

β_k^t : shadow price of the component in in month t

ε_n^t : error term veya disturbance term

The Laspeyres index is constructed for each stratum to calculate the price changes that would occur if the characteristics of the residential properties were held constant.

$$P_i^t = \frac{exp(\widehat{\beta_0^t}) exp\left[\sum_k \widehat{\beta_k^t}\, \overline{z_{nk}^0}\right]}{exp(\widehat{\beta_0^0}) exp\left[\sum_k \widehat{\beta_k^0}\, \overline{z_{nk}^0}\right]}$$

P_i^t: hedonic price index of stratum t in period t

$\widehat{\beta_k^0}$: shadow price prediction for the component in the basis period

$\widehat{\beta_k^t}$: shadow price prediction for the component in period t

$\overline{z_{nk}^0}$: average residential features in the basis period

The analytical steps in our research were as follows

- Identification of opportunity periods
- Test for correct assignment of opportunity periods (logistic regression).
- Continue the analysis if the assignments are correct.
- Descriptive statistics for opportunity and non-opportunity periods

- Analysis of variance (ANOVA) to understand if opportunity and non-opportunity periods differ.
- Analysis of variance (ANOVA) was used to determine whether there was a significant difference between opportunity periods and total residential sales.
- Analysis of variance (ANOVA) was used to determine if there was a significant difference between opportunity periods and mortgaged residential sales.
- Analysis of variance (ANOVA) was used to determine if there was a significant difference between opportunity periods and cash residential sales.

4. Analysis and Results

4.1. Residential accessibility opportunity (HoMiWaSOpp)

According to the HoMiWaSOpp equation, the periods determined as the opportunity; According to the descriptive statistics results of HoMiWaS, Adjusted Home Sales, Adjusted Mortgage Home Sales and Adjusted Cash Home Sales data as seen in Table 2:

- The calculated average HoMiWaS was 13.1 (median 13.7[1]) years for the periods defined as opportunity, and 16.2 (15.37) years for the non-opportunity periods.
- The calculated adjusted home sales average was 104 (105) thousand for the periods defined as opportunity, and 119 (112) thousand for the non-opportunity periods.
- The calculated adjusted mortgage home sales average was 30.7 (31.2) thousand for the periods defined as opportunity, and 34.8 (34.8) thousand for the non-opportunity periods.
- The adjusted cash home sales average is 73.5 (74) thousand for the opportunity periods and 85 (81) thousand for the non-opportunity periods.

Table 2 HoMiWaSOpp Descriptive Statistics

Descriptive Statistics								
	HoMiWaS		Adjusted Home Sales		Adjusted Mortgage Home Sales		Adjusted Cash Home Sales	
	0	1	0	1	0	1	0	1
Valid	78	42	78	42	78	42	78	42
Missing	0	0	0	0	0	0	0	0
Median	15.370	13.760	112.473	105.455	34.805	31.238	81.027	74.089
Mean	16.232	13.110	119.782	104.288	34.844	30.776	84.937	73.512
Std. Deviation	3.221	1.509	30.937	19.809	17.831	12.950	26.301	13.119
Coefficient of variation	0.198	0.115	0.258	0.190	0.512	0.421	0.310	0.178
Minimum	11.900	10.750	62.921	42.783	5.082	6.240	40.089	25.695
Maximum	26.900	15.220	234.951	146.903	133.909	57.811	177.705	114.155

Analysis of variance (ANOVA) was used to test whether or not the HoMiWaS variable differed according to the HoMiWaSOpp distinction; as seen in Table 3, it was found that there was a statistically significant difference between the HoMiWaS means of the opportunity and non-opportunity periods at the 99.9% confidence level. The HoMiWaS value was measured approximately three years higher in the non-opportunity periods.

[1] Mean results are given outside the brackets and median data are given inside the brackets. Example 104 (107), 104 indicates the mean result, and 107 indicates the median result.

Table 3 HoMiWaS ANOVA

Cases	Sum of Squares	df	Mean Square	F	p
HoMiWaSOpp	266.011	1	266.011	35.173	< .001
Residuals	892.418	118	7.563		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}	
0	1	3.122	0.526	5.931	< .001	***

Using analysis of variance (ANOVA) to test whether the adjusted home sales variable differs according to the HoMiWaSOpp distinction, Table 4 shows a statistically significant difference between the adjusted home sales averages of the opportunity and non-opportunity periods at the 99% confidence level. The value of adjusted home sales was about 15 thousand higher in the non-opportunity periods.

Table 4 HoMiWaSOPP Adjusted Home Sales ANOVA

Cases	Sum of Squares	df	Mean Square	F	p
HoMiWaSOpp	6553.655	1	6553.655	8.613	0.004
Residuals	89785.492	118	760.894		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}	
0	1	15.494	5.279	2.935	0.004	**

The analysis of variance (ANOVA) is used to test whether the variable adjusted mortgage home sales differs according to the HoMiWaSOpp distinction; as seen in Table 5, there is no statistically significant difference between the adjusted mortgage home sales averages of the opportunity and non-opportunity periods. We can say that the adjusted mortgage home sales averages for both periods are the same.

Table 5 Adjusted Mortgage Home Sales HoMiWaSOpp ANOVA

Cases	Sum of Squares	df	Mean Square	F	p
HoMiWaSOpp	451.782	1	451.782	1.700	0.195
Residuals	31356.702	118	265.735		

Note. Type III Sum of Squares

Post Hoc Tests *Standard*

Post Hoc Comparisons – HoMiWaSOpp

		Mean Difference	SE	t	p_{tukey}
0	1	4.068	3.120	1.304	0.195

Analysis of variance (ANOVA) was used to test whether the adjusted cash home sales variable differed according to the HoMiWaSOpp distinction; as seen in Table 6, there is a statistically significant difference at the 99% confidence level between the adjusted cash home sales averages of the opportunity and non-opportunity periods. The adjusted cash home sales value was about 11 thousand higher in the non-opportunity periods.

Table 6 Adjusted Cash Home Sales HoMiWaSOpp ANOVA

Cases	Sum of Squares	df	Mean Square	F	p
HoMiWaSOpp	3563.992	1	3563.992	6.972	0.009
Residuals	60320.583	118	511.191		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}	
0	1	11.426	4.327	2.640	0.009	**

We estimated the HoMiWaSOpp opportunity using logistic regression analysis and found that the assignment is correct at the 95% level, as shown in Table 7. The model was statistically significant at the 99.9% confidence level. The model's explanatory power was calculated as Nagelkerke R^2 87.9% and Tjur R^2 81.4%. The independent variables HoMiWaS, CPI, Mortgage Interest Rates and Real HPI were used to estimate HoMiWaSOpp. The variables Home Sales were also included in the model, but as these variables were not statistically significant, they were removed from the model, and the analysis continued. According to the calculation, 39 of the 42 identified opportunity periods were also predicted as opportunities in the model. According to the logistic regression analysis, 75 of the 78 periods identified as non-opportunity by the calculation were also predicted as non-opportunity.

Table 7 HoMiWaSOpp Logistic Regression

Model Summary - HoMiWaSOpp

Model	Deviance	AIC	BIC	df	X^2	p	McFadden R^2	Nagelkerke R^2	Tjur R^2	Cox & Snell R^2
H_0	155.387	157.387	160.175	119						
H_1	33.370	43.370	57.308	115	122.017	< .001	0.785	0.879	0.814	0.638

Coefficients

			Wald Test		
	Estimate	Standard Error	z	Wald Statistic	df	p
(Intercept)	66.652	21.600	3.086	9.522	1	0.002
HoMiWaS	-8.019	2.270	-3.532	12.478	1	< .001
CPI	-0.231	0.069	-3.348	11.210	1	< .001
Mortgage Interest Rates	1.085	0.341	3.186	10.148	1	0.001
Real HPI	0.593	0.162	3.672	13.484	1	< .001

Note. affordability opportunity level '1' coded as class 1.

Performance Diagnostics

Confusion matrix

	Predicted		
Observed	0	1	% Correct
0	75	3	96.154
1	3	39	92.857
Overall % Correct			95.000

Note. The cut-off value is set to 0.5

4.2. Loan cost opportunity (LIA, LIAD, LIAI)

4.2.1 Loan cost opportunity (LIA)

In the residential loan opportunity research, as seen in Table 8, 52 months were lower than the 12-month moving average value of the housing loan interest rate. This was the LIA of opportunity in terms of housing loan interest.

- Analysis of the descriptive statistics of mortgage interest rates, adjusted home sales, adjusted mortgage home sales and adjusted cash home sales data according to LIA classification;
- Mortgage interest rates averaged 12.3% (11.4%) per annum during the opportunistic periods and 16.3% (14.8%) per annum during the non-opportunistic periods.
- Adjusted home sales averaged 117 (107) thousand during the opportunistic periods and 112 (111) thousand during the non-opportunistic periods.
- Adjusted mortgage home sales averaged 41.9 (40.7) thousand during the periods defined as opportunity, and it was calculated as 26.9 (28.8) thousand during the non-opportunity periods.

- Adjusted cash home sales averaged 75 (73) thousand during the periods defined as opportunity, and it was calculated as 85 (80) thousand during the non-opportunity periods.

Table 8 Loan Interest Advantage Descriptive Statistics

Descriptive Statistics

	Mortgage Interest Rates		Adjusted Mortgage Home Sales		Adjusted Home Sales		Adjusted Cash Home Sales	
	0	1	0	1	0	1	0	1
Valid	68	52	68	52	68	52	68	52
Missing	0	0	0	0	0	0	0	0
Median	14.809	11.425	28.788	40.711	111.314	107.607	79.917	73.387
Mean	16.343	12.289	26.902	41.945	112.243	117.126	85.341	75.181
Std. Deviation	4.283	3.079	9.829	19.132	22.735	34.586	22.029	23.569
Coefficient of variation	0.262	0.251	0.365	0.456	0.203	0.295	0.258	0.313
Minimum	10.607	8.297	5.082	10.247	69.622	42.783	53.066	25.695
Maximum	28.948	21.808	44.801	133.909	198.510	234.951	177.705	165.483

In the analysis of variance (ANOVA) conducted to test whether the variable adjusted mortgage home sales differs according to the LIA distinction, as seen in Table 9, it was observed that there was a statistically significant difference at the 99.9% confidence level between the adjusted mortgage home sales averages of the opportunity and non-opportunity periods. The adjusted mortgage home sales value was about 15 thousand higher in the opportunity periods.

Table 9 ANOVA - Adjusted Mortgage Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
LIA	6667.944	1	6667.944	31.297	< .001
Residuals	25140.540	118	213.055		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}	
0	1	-15.043	2.689	-5.594	< .001	***

*** p < .001

In the analysis of variance (ANOVA) conducted to examine whether the adjusted cash home sales variable is different according to the LIA distinction, as seen in Table 10, it was observed that there is a statistically significant difference between the adjusted cash home sales averages of opportunity and non-opportunity periods at 95% confidence level. Adjusted cash home sales value was approximately 10 thousand lower in the opportunity periods.

Table 10 ANOVA - Adjusted Cash Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
LIA	3041.787	1	3041.787	5.899	0.017
Residuals	60842.789	118	515.617		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}	
0	1	10.160	4.183	2.429	0.017	*

* p < .05

In the analysis of variance (ANOVA) we conducted to test whether the adjusted home sales variable differs according to the LIA distinction, as seen in Table 11, no statistically significant difference was found between the adjusted home sales averages of the opportunity and non-opportunity periods. We found that credit sales increased during the opportunity periods, and cash sales decreased. We can say that the adjusted home sales averages for both periods are the same. Taken together with the other variance analysis results, the LIA did not affect total home sales.

Table 11 ANOVA - Adjusted Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
credit opportunity ma	702.530	1	702.530	0.867	0.354
Residuals	95636.618	118	810.480		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}
0	1	-4.883	5.245	-0.931	0.354

In the logistic regression analysis of the LIA opportunity, as shown in Table 12, the correct classification was found to be 86.7%. The model was statistically significant at the 99.9% confidence level. The model's explanatory power was also good, with a Nagelkerke R^2 of 62.1%. The independent variables HoMiWaS, Mortgage Interest Rates, Deposit Interest Rates and Adjusted Mortgage Home Sales were used to estimate the LIA. The variables Real HPI, CPI, Adjusted Cash Home Sales were also included in the model. However, as these variables were not statistically significant, they were removed from the model and the analysis continued. Of the 52 periods we identified, 44 of the 52 with opportunities were also predicted as opportunities due to the logistic regression. As a result of the analysis of 68 non-opportunity periods, 60 periods were predicted to be non-opportunity.

Table 12 LIA Logistic Regression

Model Summary - LIA

Model	Deviance	AIC	BIC	df	X^2	p	McFadden R^2	Nagelkerke R^2	Tjur R^2	Cox & Snell R^2
H_0	164.216	166.216	169.003	119						
H_1	89.553	99.553	113.490	115	74.663	< .001	0.455	0.621	0.514	0.463

Coefficients

				Wald Test		
	Estimate	Standard Error	z	Wald Statistic	df	p
(Intercept)	13.087	4.419	2.962	8.772	1	0.003
Mortgage Interest Rates	-1.264	0.380	-3.322	11.038	1	< .001
Interest Rates for Deposits	0.826	0.265	3.114	9.697	1	0.002
Minimum Wage House Price Ratio	-0.555	0.224	-2.480	6.152	1	0.013
Adjusted Mortgage Home Sales	0.087	0.049	1.762	3.104	1	0.078

Note. credit opportunity ma level '1' coded as class 1.

Performance Diagnostics

Confusion matrix

	Predicted		
Observed	0	1	% Correct
0	60	8	88.235
1	8	44	84.615
Overall % Correct			86.667

Note. The cut-off value is set to 0.5

4.2.2 LIAI for Housing Loans

As shown in Table 13, 33 months when mortgage rates were lower than the rate of inflation were considered to be LIAIs in terms of residential loan rates. In our LIAI classification, the descriptive statistics of the mortgage interest rates, inflation, adjusted home sales and adjusted mortgage home sales data analyses were as follows;

- Mortgage interest rates averaged 15.6% (17.8%) per annum during the periods identified as opportunities, compared to 14.2% (13%) per annum during the non-opportunistic periods.
- Inflation averaged 36.2% (19.6%) per annum during the opportunistic periods, compared to 10.8% (9.2%) during the non-opportunistic periods.
- Adjusted home sales averaged 132 (125) thousand in the opportunistic periods and 108 (106) thousand in the non-opportunistic periods.
- Adjusted mortgage home sales averaged 38,000 (32,000) in the opportunistic periods, and 32,000 (34,000) in the non-opportunistic periods.
- Adjusted cash home sales averaged 94,000 (92,000) in the periods defined as opportunities, and 76,000 (74,000) in the non-opportunity periods.

Table 13 Loan Interest Advantage Descriptive Statistics

Descriptive Statistics

	Mortgage Interest Rates		Inflation		Adjusted Home Sales		Adjusted Mortgage Home Sales		Adjusted Cash Home Sales	
	0	1	0	1	0	1	0	1	0	1
Valid	87	33	87	33	87	33	87	33	87	33
Missing	0	0	0	0	0	0	0	0	0	0
Median	13.030	17.797	9.219	19.583	105.864	124.691	34.357	32.030	73.520	92.049
Mean	14.197	15.612	10.848	36.230	107.611	132.148	31.685	37.995	75.926	94.153
Std. Deviation	4.398	3.895	4.354	28.784	21.541	36.241	11.690	24.433	18.929	28.018
Coefficient of variation	0.310	0.249	0.401	0.794	0.200	0.274	0.369	0.643	0.249	0.298
Minimum	8.766	8.297	6.134	8.297	42.783	62.921	5.082	13.592	25.695	40.089
Maximum	28.948	21.575	25.240	85.515	192.889	234.951	57.811	133.909	144.896	177.705

In the analysis of variance (ANOVA) we conducted to test whether the Adjusted Home Sales variable differed according to the LIAI distinction, as seen in Table 14, we found that there was a statistically significant difference between the adjusted home sales averages of the opportunity and non-opportunity periods at the 99.9% confidence level. The value of adjusted home sales was about 25 thousand higher in the opportunity periods.

Table 14 ANOVA - Adjusted Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
LIAI	14404.781	1	14404.781	20.745	< .001
Residuals	81934.366	118	694.359		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}	
0	1	-24.537	5.387	-4.555	< .001	***

*** p < .001

In the analysis of variance (ANOVA), we conducted to test whether our adjusted mortgage home sales variable differed according to the LIAI distinction. Table 15 shows no statistically significant difference between the adjusted mortgage home sales averages of the opportunity and non-opportunity periods. We can say that the adjusted mortgage home sales averages were the same for both periods.

Table 15 ANOVA - Adjusted Mortgage Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
LIAI	952.471	1	952.471	3.642	0.059
Residuals	30856.014	118	261.492		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}
0	1	-6.310	3.306	-1.909	0.059

In the analysis of variance (ANOVA) we conducted to test whether our adjusted cash home sales variable differed according to the LIAI distinction, as seen in Table 16, there was a statistically significant difference between the Adjusted Cash Home Sales averages of the opportunity and non-opportunity periods at the 99.9% confidence level. The adjusted cash home sales value was approximately 18 thousand higher in the opportunity periods. Evaluated in conjunction with other variance analyses, the fact that loan sales did not change suggests that buyers did not view loan rates as an opportunity in the opportunity periods when residential loan rates were below inflation. In this respect, we found that, although the interest rates of the public banks were kept low, the fact that there were not enough residential loans in the market (low limits), and the high-interest rates of the private banks were ineffective in the sales on loans. One thing that stood out during that period was that those who had bought a house for cash had bought or invested in more houses during high inflation.

Table 16 ANOVA - Adjusted Cash Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
LIAI	7949.079	1	7949.079	16.769	< .001
Residuals	55935.497	118	474.030		

Note. Type III Sum of Squares

		Mean Difference	SE	t		p_{tukey}
0	1	-18.228	4.451	-4.095	< .001	***

*** p < .001

In our prediction of the LIAI opportunity based on logistic regression analysis, we found that 86.7% of the assignments were correct, as shown in Table 17. Our model was statistically significant at the 99.9% confidence level. The model's explanatory power was also good with a Nagelkerke R^2 of 64%. The independent variables HoMiWaS, mortgage rates, deposit rates and real HPI were used to estimate the LIAI. Home sales variables were also included in the model but were excluded as they were not statistically significant. Of the 33 periods we identified as opportunities, 24 were also predicted as opportunities by logistic regression. Of the 87 non-opportunity periods, 80 were predicted to be non-opportunity.

Table 17 LIAI Logistic Regression

Model Summary - LIAI

Model	Deviance	AIC	BIC	df	X^2	p	McFadden R^2	Nagelkerke R^2	Tjur R^2	Cox & Snell R^2
H_0	141.161	143.161	145.948	119						
H_1	70.980	80.980	94.917	115	70.181	< .001	0.497	0.640	0.530	0.443

Coefficients

				Wald Test		
	Estimate	Standard Error	z	Wald Statistic	df	p
(Intercept)	-9.495	2.613	-3.634	13.205	1	< .001
Mortgage Interest Rates	-1.294	0.342	-3.781	14.296	1	< .001
HoMiWaS	-0.797	0.284	-2.801	7.848	1	0.005
Interest Rates for Deposits	0.877	0.243	3.614	13.062	1	< .001
Real HPI	0.229	0.055	4.181	17.482	1	< .001

Note. Campaign vs Inflation level '1' coded as class 1.

Performance Diagnostics

Confusion matrix

	Predicted		
Observed	0	1	% Correct
0	80	7	91.954
1	9	24	72.727
Overall % Correct			86.667

Note. The cut-off value is set to 0.5

4.2.3 Residential Loan Opportunity Deposit (LIAD)

The eight months when the resident loan rate was lower than the deposit rate (Table 18) were LIADs of opportunity regarding residential loan rates. The analysis of descriptive statistics of mortgage rates, deposit rates, adjusted house sales and adjusted mortgage house sales data according to our LIAD classification;

- Mortgage interest rates averaged 16.4% (15.9%) per annum during opportunistic periods and 14.5% (13.3%) during non-opportunistic periods.
- Interest rates on deposits averaged 17.9% (18.4%) per annum during the opportunistic periods and 11.4% (9.8%) per annum during the non-opportunistic periods.
- Adjusted home sales averaged 115,000 (117,000) in opportunistic periods and 114,000 (109,000) in non-opportunistic periods.
- Adjusted mortgage home sales averaged 33,000 (31,000) in the periods defined as opportunity and 33,000 (34,000) in the non-opportunity periods.

Adjusted cash home sales averaged 81 (80) thousand in the opportunity periods and 81 (76) thousand in the non-opportunity periods. Regarding standard deviations, the standard deviation of the opportunity period was approximately 7 thousand, and the standard deviation of the non-opportunity period was 24 thousand.

Table 18 Loan Interest Advantage Descriptive Statistics

Descriptive Statistics

	Mortgage Interest Rates		Interest Rates for Deposits		Adjusted Mortgage Home Sales		Adjusted Home Sales		Adjusted Cash Home Sales	
	0	1	0	1	0	1	0	1	0	1
Valid	112	8	112	8	112	8	112	8	112	8
Missing	0	0	0	0	0	0	0	0	0	0
Median	13.311	15.926	9.771	18.373	34.127	31.300	108.712	116.822	76.136	79.785
Mean	14.454	16.433	11.435	17.922	33.416	33.489	114.324	114.841	80.909	81.352
Std. Deviation	4.327	3.563	4.168	3.480	16.292	18.303	28.835	24.035	23.920	7.277
Coefficient of variation	0.299	0.217	0.364	0.194	0.488	0.547	0.252	0.209	0.296	0.089
Minimum	8.297	12.982	5.264	13.273	5.082	10.247	42.783	85.897	25.695	73.520
Maximum	28.948	21.808	22.852	22.170	133.909	57.811	234.951	146.903	177.705	90.250

In the Analysis of Variance (ANOVA), we analysed whether our adjusted home sales variable was different according to the LIAD distinction; as seen in Table 19, there was no statistically significant difference between the Adjusted Home Sales averages of the opportunity and non-opportunity periods. We noted that both periods' Adjusted Home Sales averages were the same.

Table 19 ANOVA - Adjusted Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
LIAD	1.989	1	1.989	0.002	0.961
Residuals	96337.159	118	816.417		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}
0	1	-0.516	10.457	-0.049	0.961

In the analysis of variance (ANOVA), we conducted to analyse whether our adjusted mortgage home sales variable was different according to the LIAD distinction; as seen in Table 20, there was no statistically significant difference between the adjusted mortgage home sales averages of the opportunity and non-opportunity periods. We noted that both periods' adjusted mortgage home sales averages were the same.

Table 20 ANOVA - Adjusted Mortgage Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
LIAD	0.040	1	0.040	1.481×10-4	0.990
Residuals	31808.445	118	269.563		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}
0	1	-0.073	6.009	-0.012	0.990

In the Analysis of Variance (ANOVA), we examined whether our adjusted cash home sales variable differed according to the LIAD distinction; as seen in Table 21, there was no statistically significant difference between the adjusted cash home sales averages of the opportunity and non-opportunity periods. We noted that both periods' adjusted cash home sales averages were the same. We analysed the results together with other variance analyses. We found that in the opportunity periods when residential loan rates were lower than deposit rates, loan rates were not perceived as an opportunity by buyers. The difficulty of monthly follow-up could be considered as a factor.

Table 21 ANOVA - Adjusted Cash Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
LIAD	1.464	1	1.464	0.003	0.959
Residuals	63883.12	118	541.382		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}
0	1	-0.443	8.515	-0.052	0.959

Regarding predicting the LIAD opportunity with logistic regression analysis, as shown in Table 22, we found that the classification was generally correct at 95%. Our model was statistically significant at the 99.9% confidence level. The exmodel's explanatory power also at the Nagelkerke R^2 level of 52%. However, the correct assignment rate for the opportunity period was at a very low level of 25%. Only two of the eight opportunity periods were also predicted as opportunities in the logistic regression. All of the 112 non-opportunity periods were predicted as non-opportunity. The results of the analysis of variance and the logistic regression taken together showed that the periods when mortgage rates were lower than deposit rates could not be defined as opportunities. The fact that loan rates were lower than deposit rates in only eight months of the ten years complicated the analysis.

Table 22 LIAD Logistic Regression

Model Summary - credit opportunity

Model	Deviance	AIC	BIC	df	X^2	p	McFadden R^2	Nagelkerke R^2	Tjur R^2	Cox & Snell R^2
H_0	58.783	60.783	63.571	119						
H_1	31.834	43.834	60.559	114	26.950	< .001	0.458	0.519	0.368	0.201

Coefficients

				Wald Test		
	Estimate	Standard Error	z	Wald Statistic	df	p
(Intercept)	24.976	12.065	2.070	4.285	1	0.038
Minimum Wage House Price Ratio	-0.804	0.381	-2.113	4.465	1	0.035
Mortgage Interest Rates	0.099	0.137	0.725	0.525	1	0.469
Real HPI	-0.182	0.123	-1.483	2.200	1	0.138
Adjusted Mortgage Home Sales	0.026	0.032	0.837	0.701	1	0.403
Adjusted Cash Home Sales	0.002	0.024	0.087	0.008	1	0.931

Note. Credit opportunity level '1' coded as class 1.

Performance Diagnostics

Confusion matrix

	Predicted		
Observed	0	1	% Correct
0	112	0	100.000
1	6	2	25.000
Overall % Correct			95.000

Note. The cut-off value is set to 0.5

4.3. Cheap Housing Opportunity (CHO)

We defined 32 months with negative annual real house price changes as a cheap residential opportunity (CHO). Our analysis of the descriptive statistics of real HPI, adjusted home sales and

adjusted mortgage home sales data according to our CHO classification (Table 23) provided the following findings:

- The calculated Real HPI average was 111 (109) for the periods defined as opportunity and 125 (118) for the non-opportunity periods.
- The calculated adjusted home sales average was 117 (117) thousand for the periods defined as opportunity, and 113 (107) thousand for the non-opportunity periods.
- The calculated adjusted mortgage home sales average is 29 (30) thousand for the periods defined as opportunity and 35 (35) thousand for the non-opportunity periods.
- The calculated adjusted cash home sales average was 88 (81) thousand for the periods defined as opportunity, and 78 (74) thousand for the non-opportunity periods.

Table 23 Cheap Housing Opportunity Descriptive Statistics

Descriptive Statistics

	Real HPI		Adjusted Home Sales		Adjusted Mortgage Home Sales		Adjusted Cash Home Sales	
	0	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Valid	88	32	88	32	88	32	88	32
Missing	0	0	0	0	0	0	0	0
Median	118.040	108.895	106.888	117.225	34.524	30.304	73.994	81.033
Mean	125.151	111.389	113.218	117.496	34.946	29.224	78.272	88.272
Std. Deviation	27.588	8.867	29.596	25.213	16.501	15.400	23.590	20.577
Coefficient of variation	0.220	0.080	0.261	0.215	0.472	0.527	0.301	0.233
Minimum	100.000	101.440	42.783	69.622	10.732	5.082	25.695	63.382
Maximum	223.630	123.330	234.951	192.889	133.909	57.811	177.705	144.896

According to the analysis of variance (ANOVA), we conducted to analyse whether the Adjusted Home Sales variable differed based on the CHO distinction, there was no statistically significant difference between the adjusted home sales averages in the opportunity and non-opportunity periods. the adjusted home sales averages for both periods were the same (Table 24).

Table 24 ANOVA - Adjusted Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
CHO	429.539	1	429.539	0.528	0.469
Residuals	95909.609	118	812.793		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}
0	1	-4.278	5.885	-0.727	0.469

According to the analysis of variance (ANOVA, we conducted to analyse whether the adjusted mortgagee home sales variable differed based on the CHO distinction, there was no statistically significant difference between the adjusted mortgage home sales averages in the opportunity and non-opportunity periods. The adjusted mortgage home sales averages for both periods were the same (Table 25).

Table 25 ANOVA - Adjusted Mortgage Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
CHO	768.280	1	768.280	2.921	0.090
Residuals	31040.205	118	263.053		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}
0	1	5.722	3.348	1.709	0.090

According to the analysis of variance, we conducted to analyse whether the adjusted cash home sales variable differed based on the CHO distinction. There was a statistically significant difference

at a 95% confidence level between the adjusted cash home sales averages in the opportunity and non-opportunity periods. Adjusted cash home sales value was measured as approximately ten thousand higher during periods of opportunity (Table 26). The times when annual real house price changes are seen and considered as opportunities by cash buyers, who have the cash available to buy a property outright.

Table 26 ANOVA - Adjusted Cash Home Sales

Cases	Sum of Squares	df	Mean Square	F	p
CHO	2346.765	1	2346.765	4.500	0.036
Residuals	61537.810	118	521.507		

Note. Type III Sum of Squares

		Mean Difference	SE	t	p_{tukey}	
0	1	-10.000	4.714	-2.121	0.036	*

* p < .05

The prediction of CHO opportunity, constructed using logistic regression analysis, showed that the correct assignment was generally achieved at 92.5%. Our model was statistically significant at a 95% confidence level. The explanation level of the model was at a good level of Nagelkerke R^2 83.9%. The independent variables HoMiWaS, mortgage interest rates, deposit interest rates, adjusted cash home sales, adjusted mortgage home sales and HPI were used to estimate CHO. Of the 32 periods we defined as opportunities, 25 were also predicted as opportunities by logistic regression. 86 of the 88 non-opportunity periods were predicted to be non-opportunities. The correct assignment rate was 78.1% for opportunities and 97.7% for non-opportunities.

Table 27 Cheap Housing Opportunity Logistic Regression

Model Summary - CHO

Model	Deviance	AIC	BIC	df	X^2	p	McFadden R^2	Nagelkerke R^2	Tjur R^2	Cox & Snell R^2
H_0	139.180	141.18	143.967	119						
H_1	36.284	50.284	69.796	113	102.896	< .001	0.739	0.839	0.755	0.576

Coefficients

				Wald Test		
	Estimate	Standard Error	z	Wald Statistic	df	p
(Intercept)	42.036	16.830	2.498	6.238	1	0.013
Mortgage Interest Rates	-2.598	0.908	-2.863	8.195	1	0.004
Interest Rates for Deposits	5.567	1.729	3.219	10.361	1	0.001
HPI	-0.226	0.073	-3.080	9.486	1	0.002
Adjusted Cash Home Sales	0.178	0.081	2.214	4.901	1	0.027
HoMiWaS	-3.208	1.147	-2.797	7.826	1	0.005
Adjusted Mortgage Home Sales	0.141	0.072	1.973	3.893	1	0.048

Note. CHO level '1' coded as class 1.

Performance Diagnostics

Confusion matrix

	Predicted		
Observed	0	1	% Correct
0	86	2	97.727
1	7	25	78.125
Overall % Correct			92.500

Note. The cut-off value is set to 0.5

5. Discussion and Conclusion

Property is a valuable household asset (Zorn & Sackley, 1991; Henderson & Ioannides, 1983). Many economic and social motivations exist behind accessing this valuable asset (Erdoğdu & Büyükduman, 2018; Lux et al., 2017). One of the reasons for investing in property is to get out of renting and the other is to increase wealth while saving (Triantafyllopoulos & Kandyla, 2010; De Bruin & Flint-Hartle, 2003). Individuals usually start to invest in property when they buy a property for themselves or when they see their neighbours buying a property for investment, but speculators

in the market also encourage individuals to invest in property (Bayer, et al., 2016; Fu & Qian, 2014). There are different types of property investors, including intermediaries and speculators. There are differences between residential and property investors; property investors are professional in their investments (D'Lima & Schultz, 2021). In residential investment, decisions based on personal experience, incomplete and limited information, and hearsay come to the fore (De Bruin, Flint-Hartle, 2003; Gallimore & Gray, 2002; Lux et al., 2017; Case & Shiller, 1988). Residential investors do not do proper risk analyses and financial comparisons and may even invests at price peaks (De Bruin & Flint-HArtle, 2003; Bayer et al., 2020).

Individual residential investors are influenced by each other and by the media. The influence of the media is less visible than that of individuals, but the media also has indirect influences. Over time, individual investors internalise the opinions they hear from the media and the individuals around them (Shiller, 1995; Triantafyllopoulos & Kandyla, 2010; Katz, 2006; Shiller, 2015). The media, individuals' opinions, and the fear of regret can harm residential investors and homebuyers. The fact that individuals do not carry out risk analysis and financial comparisons on residential investments makes it difficult for residential investors to succeed. As a result, residential investors pay more for houses when they are just starting and make less profit when they invest in the property they will live in (Bayer, et al., 2016; D'Lima & Schultz, 2021).

In the literature review, we examined the importance of residential property to households, motivations for buying residential property, types of residential property investors, starting to invest in residential property, differences between residential property investors and other property investors, residential property affordability scales, investor behaviour in response to residential property price changes, residential property prices and investors in developing countries, the influence of investors on the residential property market, the influence of the residential property market on investors, personal experiences of investing, investors' approaches to finance and risk analysis, sources of investor influence, pressures and stresses on residential property investors, situations in which residential property investors' profits rise and fall.

We aimed to find indicators that could be produced for the housing market to make investors more sensitive to market data in residential investment. Our research sought to answer the following questions: Can indicators be created to enable residential investors to profit more from their investments? Are there periods of opportunity for residential investors? Can residential investors identify periods of opportunity within the market dynamics? How sensitive are investors to opportunities in residential investment? To find answers to these questions, we analysed publicly available data on the residential property market.

The first topic of our research was whether investors were interested in residential investment in periods when the price of a property became 'accessible' to income, according to the minimum wage (income) property price multiplier scale. In the residential property accessibility scale (HoMiWaS), we analysed the existence of periods of opportunity (HoMiWaSOpp) in the research period 2013/2022. We measured a total of 42 periods as HoMiWaSOpp for 120 months. During this period, we measured HoMiWaSOpp at an average of 13.1 years. Non-opportunity periods were measured at 16.2 years. During the HoMiWaSOpp periods there were 104 thousand property sales, 30 thousand loan sales, and 73 thousand cash sales.

We observed that property sales decreased by 12%, loan sales by 11% and cash sales by 14% in the opportunity periods. The expected result was an increase in sales in the opportunity periods. We tested the opportunity periods using logistic regression. We found that 39 of the 42 periods were accurately identified as HoMiWaSOpp. We found that 75 of the 78 periods were accurately identified as non-opportunity periods. In the non-opportunity periods, the figures were 119,000, 34,000 and 85,000 respectively. We found that between 2013 and 2022, residential property investors in Türkiye did not consider the opportunity of access to residential property by minimum income.

The second topic of our research was whether the opportunity presented by favourable residential loan rates relative to other indicators had attracted the interest of residential investors. In our first comparison, we referred to the periods of opportunity when residential loan rates were lower than the previous 12-month moving average as LIA. We calculated 52 months out of 120 periods from 2013 to 2022 as LIA. We calculated the residential loan rate to be 12.3% in the LIA periods and 16.3% in the non-opportunity periods. During the LIA periods, residential sales were computed as 117,000, credit sales as 41,000, and cash sales as 75,000. In the non-LIA periods, the figures were 112,000, 26,000, and 85,000, respectively. During the LIA periods, we found that house sales increased by 4%, loan sales increased by 56%, and cash sales decreased by 12%. We tested the opportunity periods using logistic regression. 44 of the 52 periods we identified as LIA, and 60 of the 68 non-opportunity periods were correctly identified. According to the results of our analysis, in the LIA periods, cash buyers reduced their number of purchases by taking advantage of the opportunity, loan purchases increased, and the increase of only 4% in total house purchases may be indicative of cash buyers taking advantage of the opportunity.

We called the second of the three indicators of credit affordability the periods when residential loan interest rates were lower than the rate of inflation, LIAI. We defined 33 months out of 120 periods in the 2013-2022 period as LIAI. We calculated the housing loan interest rate as 15.6% in LIAI periods and 14.2% in non-opportunity periods. We calculated the annual inflation rate to be 36.2% and 10.8% in the LIAI periods. We calculated that in the LIAI periods, there were 132,000 house sales, 38,000 loan sales and 94,000 cash sales. In the non-LIAI periods, the figures were 108,000, 32,000 and 76,000, respectively. We calculated that house sales increased by 22%, credit sales by 19%, and cash sales by 24% in the LIAI periods. We tested the opportunity periods using logistic regression. We found that 24 of the 33 periods were accurately identified as LIAI, and 80 of the 87 periods were accurately identified as non-opportunity periods. According to our analysis, cash buyers took the opportunity, and cash property sales increased in the LIAI periods. The difference between the mean values of cash sales was not statistically significant at a 95% confidence level but was statistically significant at a 90% confidence level. Although the opportunity periods were accurately identified, the results may not have been as expected under opportunity conditions because the opportunity period was affected by one of Türkiye's crisis periods.

We named the third of the three indicators of loan affordability the periods when residential loan rates were lower than deposit rates, as LIAD. We calculated eight months out of 120 periods in the 2013/2022 period as LIAD. We calculated the residential loan interest rate as 16.5 per cent in LIAD periods and 14.5 per cent in non-opportunity periods. We measured the deposit interest rate as 17.9% per annum and 11.4% per annum in the LIAD periods. Home sales were 115,000, credit sales were 33,000, and cash sales were 81,000 in the LIAD periods. In the non-opportunity periods, we calculated 114,000, 33,000 and 81,000, respectively. We tested the opportunity periods using logistic regression. Only two of the eight periods we identified as LIAD were accurately identified. All 112 periods were accurately identified as non-opportunity periods. According to the analysis of variance (ANOVA) we conducted for total residential sales, loan residential sales and cash residential sales in the LIAD periods, there was no significant difference between the mean values. According to variance analyses combined with other analyses, LIAD periods may not be perceived by buyers as an opportunity to obtain a residential property loan. This result can also be explained by the difficulty of following the LIAD monthly. According to the results of the analysis of variance and the logistic regression evaluated together, periods in which the interest rates on residential loans are lower than the interest rates on deposits cannot be defined as LIAD. In the 120 months, the loan rates lower than deposit rates for only eight months made the analysis challenging.

The third theme of our research was the relationship between the real year-on-year change in residential property prices and residential property sales. The periods in which residential property prices fell in real terms were referred to as CHO. We analysed whether the possibility of a negative change in residential property prices attracted the attention of residential property investors. We

identified 32 months out of 120 periods in 2013-2022 as CHO. We calculated the real house price index as 111 in CHO periods and 125 in non-opportunity periods. In CHO periods, residential sales were calculated as 117 thousand, loan sales as 29 thousand and cash sales as 88 thousand. In the non-opportunity periods, they were calculated as 113 thousand, 35 thousand and 78 thousand, respectively. We tested for periods of opportunity using logistic regression. We accurately identified 25 of the 32 periods as CHO. We accurately identified 86 of the 88 periods as non-opportunity periods. We analysed CHO by total residential sales, loan residential sales and cash residential sales using analysis of variance (ANOVA). We found no statistically significant difference between the CHO and non-opportunity periods in terms of the mean values of total residential sales. No statistically significant difference was found in the means of credit house sales during the CHO periods and non-opportunity periods. However, a statistically significant difference was found between the means of cash house sales in the CHO periods. According to our analysis, cash buyers might consider the CHO periods as opportunity periods.

The challenges we encountered in our research were in interpreting the data. In the last decade, Türkiye experienced many events that can be described as crises. These include the Gezi events (2013), the Russian aircraft crisis (2015), the 15 July coup attempt (2016), the Pastor Brunson crisis (2018), COVID-19 (2020-2021) and currency shock (2021). In addition to these major crises, there were also relatively minor events. Although the opportunity periods were accurately identified, the results may not have been as expected by the opportunity conditions because the opportunity period was affected by one of the above periods.

As a result of our research, the changes in cash residential sales were particularly noteworthy. We concluded that cash residential buyers took advantage of the LIA, LIAI and CHO opportunities. HoMiWaS, the minimum income residential property price scale, did not affect residential property sales. We believe that the 19% purchasing power advantage of HoMiWaSOpp over non-opportunity periods should not be overlooked. HoMiWaSOpp has 42 period of 120-months period. We believe that LIA has not received the attention it deserves due to differences in residential loan rates between public and private banks in Türkiye and occasional residential loan promotions. We believe the LIAD should be analysed again for when Türkiye reaches a stable economic structure and when banks offer different interest rates on housing loans depending on their capital structure. The LIAD has not proved to be a helpful indicator due to the monetary policies implemented in Türkiye. Like the LIA, we believe that the LIAD should also be re-analysed in the future.

For future research, we recommend surveying residential property buyers in Türkiye to find out whether they make rational decisions and what they pay attention to when buying a property. They are interested in changes in residential loan interest rates, real residential property prices and changes in foreign currency-indexed residential property prices. The results of this research will be helpful for the scales to be developed in the future. Secondly, we can propose to study the effects of the opportunity scales we have developed for different income groups. The findings of this research will reveal whether there are differences in approach between different income groups.

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Resume

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