

INVESTING IN HOUSING VS REIFS: TÜRKIYE REAL ESTATE INVESTMENT FUND INDEX

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Abstract. The aim of this study is to compare the risk-return performances of real estate investment funds, a rising real estate capital market instrument in Türkiye, and housing prices, which skyrocketed in recent years in Türkiye under high inflationary periods. The research was conducted for the data obtained between March 2020 and May 2024 in 4 different periods (2020–2024), (2021–2024), (2022–2024) and (2023–2024). The risk-return performance analysis used monthly and quarterly returns of the housing prices and real estate investment funds. Sharpe ratio was calculated for each investment tool. Due to the negative Sharpe ratios obtained for some real estate investment funds, the performances were retested by the Modified Sharpe ratio. The research also used the consumer price index (CPI) as the primary benchmark tool. The research results revealed that except for the last period analyzed, where the increase in housing prices slowed, housing prices overperformed the real estate investment funds. The quarterly data analysis gave better performance results for the REIFs compared to the monthly data. This study is the most comprehensive research regarding the number of real estate investment funds and the period it covered. Establishing Türkiye Real Estate Investment Fund Index was also suggested for the first time.

Keywords: housing prices, real estate investment funds, high inflation, REIF Index, Sharpe ratio.

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1. Introduction

In the last decade, especially after the Coronavirus Disease (COVID-19) pandemic, purchasing a house has become almost impossible for a mid-level income population. In the second quarter of 2018, the Turkish housing market suffered due to high interest rates and relatively low sales compared to other years. In 2017, there were 1.4 million total housing sales, which fell to 1.38 million in 2018 with a 3% decline. Although this was not a significant drop, a remarkable and sharp decline was observed in the mortgaged sales rate of 33.6% and 20.1% in 2017 and 2018, respectively (Turkstat, 2025a). The COVID-19 pandemic crushed the global economy in 2020, and housing prices boomed worldwide thereafter. The monetary expansion policies of the central banks created high inflation in developed and emerging economies, and the ongoing Russia-Ukraine war prolonged the impact of inflation on our lives. In addition to the COVID-19 and ongoing war on its north border, Türkiye was also affected by the catastrophic earthquake in February 2023, which covered 11 cities and 15% of the country's population.

Furthermore, Türkiye carried the economic and social burden of more than 3 million official Syrian refugees it hosted since the beginning of the civil war in Syria in 2011. Among the Organization for Economic Co-operation and Development countries, Türkiye was ranked first in terms of the rise in housing sales and rental prices in the post-COVID-19 period (Organization for Economic Co-operation and Development [OECD], 2024). Prolonged monetary expansion policies of the Central Bank of Türkiye Republic, which accelerated the increase in inflation, resulted in a rapid surge in interest rates after the second half of 2023. At the end of 2024, the rate of yearly mortgaged sales fell to 10.7% of the total sales, to a historically low record (Turkstat, 2025a). The interest rates went up to 50%, and purchasing a house became almost impossible for low- and mid-income households (Central Bank of Türkiye Republic [CBRT], 2025).

On the other hand, the real estate investment funds, which are relatively new real estate capital market instruments in Türkiye, have been gaining importance in recent years. Investing in real estate through capital market instruments provides liquidity to the investors and helps

them get the return of a pool of investments instead of focusing on and dealing with one single investment. In July 2024, the Capital Markets Board of Türkiye issued a new type of real estate investment fund under the name of "Project Real Estate Investment Fund (P-REIF)". This new regulation enables the funds to develop housing projects and invest in housing units under construction.

During periods of high inflation, housing and REIFs are theorized to serve as effective hedging instruments due to their underlying exposure to tangible, income-generating assets. Theoretically, the value of real estate tends to rise with general price levels, while rental incomes—particularly in residential sectors—may adjust upward in response to inflation, thus preserving real returns. REIFs, as pooled investment vehicles, offer diversified exposure to real estate assets and often benefit from professional management and economies of scale. In inflationary environments, REIFs may outperform fixed-income securities, which typically suffer from declining real yields, and may even rival equities, depending on the structure and duration of rental contracts, leverage levels, and the responsiveness of property valuations. While some studies confirm their role as inflation hedges, particularly in developed markets, others highlight the sensitivity of REIF performance to interest rate volatility and investor sentiment during inflationary shocks.

Thus, analyzing the risk-return performances of real estate investment funds and the housing prices would help individual and institutional investors with their future investment decisions and shed light on new P-REIFs about the potential returns of the housing investments they make.

This research first takes the current picture of the housing market of Türkiye and then describes the real estate investment funds (REIFs) and the P-REIFs. Next, the performances of REIFs, the average housing sales prices of Türkiye, and the largest cities, including İstanbul, Ankara, and İzmir, are analyzed using Sharpe and Modified Sharpe ratios. The Consumer Price Index (CPI) is also used as a benchmark tool to check the hedging abilities of real estate investment funds and the housing prices against inflation. Considering the analysis results, the study suggests establishing a new index called *Real Estate Investment Fund Index* for the first time in the Turkish real estate capital markets and provides policy recommendations for Project Real Estate Investment Funds, which aim to increase the housing supply and affordability.

2. Past literature

Due to their direct and indirect contribution and impact on the economies, the real estate capital market instruments are considered interesting research areas. Many scholars researched various aspects of real estate investments, including primarily real estate investment trusts (REITs), real estate investment funds (REIFs), and real estate-based capital market instruments. Some studies examined fund returns directly, while others explored the indirect impact of various factors, such as management traits and sustainability, on the funds. For instance, while Maurer et al.

(2004) in their study stated that the financial characteristics of open-ended real estate funds in Germany are similar to direct real estate investments in many aspects and that these funds are suitable for medium- and long-term investments, Gullett and Redman (2005) compared the risk-adjusted returns of real estate investment funds with equity mutual funds. They identified three key variables that impact the risk-adjusted returns of real estate investment funds: correlation with stock market returns, expense ratio, and tax efficiency. They also emphasized that including real estate investment funds in an equity mutual fund portfolio could positively impact risk/return.

Philpot and Peterson (2006) found that real estate investment funds managed by a single fund manager in the US had higher risk-adjusted returns than those managed by a team. Fuerst and Matysiak (2013), in their analysis of non-public real estate fund performance, identified key factors influencing fund performance, including direct property returns, fund size, investment style, the country's overall economic conditions, and asset classes. Schnejar et al. (2022) determined that in Germany—the world's largest open-ended real estate fund market—funds with a higher share of institutional investors had a greater likelihood of closure (liquidation). The researchers noted that well-informed investors could act more quickly and decisively, and that older funds remained open longer.

One of the first and most comprehensive studies in the field of real estate investment funds in Türkiye was conducted by Sümer (2017), who proposed using real estate investment funds and pension funds together in an investment and financing ecosystem for project financing. This study suggested a sustainable, interest-free, alternative project financing model under the Türkiye Real Estate Fund, where sub-funds would be established for each investment project. These sub-funds would attract investments from various financiers and investor groups, including pension funds, banks, foundations, endowments, individual and institutional investors, and insurance companies. Another early research in Türkiye was conducted by Şengül (2017), who evaluated the application areas of real estate investment funds in Türkiye. The author stated that REIFs could significantly contribute to the national economy and highlighted the importance of the supervision of REIFs by the Capital Markets Board, and their management by expert portfolio managers provided trust. However, he also pointed out the shortcomings of regulations, insufficiently qualified real estate development specialists, deficiencies in the valuation system, and issues related to ownership, zoning, and construction processes.

Shoeib (2019) evaluated real estate investment funds from an Islamic perspective and proposed an integrated model for a new type of fund called the Small and Medium-Sized Fund, which includes Islamic funds. Although real estate investment funds are investment instruments, they are also considered an indirect financing tool. Çamlıbel et al. (2021) conducted a risk-return analysis of real estate investment funds, evaluating the limited number of REIFs established and accessible during their research us-

ing Sharpe and Treynor ratios. They compared their findings with the returns of the BIST-100 index for the same research period. This pioneering study emphasized that portfolio diversification in real estate investment funds could be an essential factor in increasing returns.

Kaya and Akbalık (2021) surveyed the managers of portfolio management companies that had established REIFs and proposed several recommendations for developing REIFs. These recommendations included VAT and title deed fee exemptions and strengthening the investment link between the private pension system and REIFs.

In one of the latest studies, Sümer (2023a) proposed a new and alternative housing finance model by integrating private pension funds, real estate investment funds, and the diminishing musharakah (an Islamic finance tool) approach. In this model, homebuyers and home sellers are brought together within a real estate investment fund, where sellers contribute their properties and buyers invest their savings. The model establishes a shared ownership structure based on the property's value. Under this system, which grants direct occupancy rights to homebuyers in properties with a usage permit, the buyer pays rent proportional to the share of the property they do not yet own (e.g., if the buyer has paid 20% of the house, they only pay rent for the remaining 80%). The buyer gradually increases their ownership stake by directing their savings into REIF, including those accumulated in private pension funds. This study is significant in demonstrating the contribution of real estate investment funds to the real estate sector by proposing their use as a financing tool for housing and urban transformation projects. In another study, Sümer (2023b) investigated whether 33 REITs and 15 REIFs in Türkiye provided inflation protection during COVID-19. The study found that, apart from four REITs and one REIF, none of the portfolios analyzed—including benchmark indicators such as gold, the BIST-100, and the REIT index—offered statistically significant inflation protection during the pandemic.

3. Turkish housing industry

Türkiye is a developing country with a population exceeding 85 million as of the end of 2024 (Turkstat, 2025b). Moreover, due to regional wars in the north and the south of the country, Türkiye hosts around 4.6 million refugees and immigrants (Presidency of Migration Management, 2024). In addition to the external migration, the internal movement of millions rose rapidly within the last two years after the 2023 earthquake, which affected 11 cities in the east and southeast of Türkiye. Hence, the demand is high, but supply is limited due to the high cost of construction and land, thanks to the high inflation the country experienced after the pandemic. Housing sales and rental prices have skyrocketed in the last five years.

Thus, market equilibrium, achieved through the balance of supply and demand, is crucial for maintaining stable housing prices. Yet, changes in demographics primarily influence purchasing demand (Wang & Kinugasa, 2022),

while income levels and population growth serve as key factors driving long-term price trends (Igan & Loungani, 2012). Unfortunately, for low- and middle-income Turkish citizens, owning a home has become an increasingly unreachable dream. Renting is as challenging as buying, particularly in major metropolitan areas such as Istanbul, İzmir, and Ankara (Sümer, 2024). Indeed, the homeownership rate in Türkiye has declined in the last decade. Compared to the average homeownership rates in the EU and the US, which are 69.1% and 65.2%, respectively, this rate is only 56.2% in Türkiye (Tradingeconomics, 2024). For a better understanding of the dynamics of the Turkish housing industry, it is critical to analyze the number of sales, mortgaged sales, the number of building and occupancy permits, the inflation and interest rates, and the construction costs.

The Turkish housing sector has experienced significant growth, particularly over the past 20 years, during which real estate development processes have been handled professionally. With the enactment of the reciprocity law in 2013, which facilitated property sales to foreigners, the housing market continued to expand rapidly. Although the sector has followed a fluctuating course depending on cyclical developments, the housing industry remains one of the key determinants of the real estate market, considering the growing population.

According to the Turkish Statistical Institute (Turkstat), more than 1 million housing units have been sold annually in Türkiye since 2013. Since 2020, this number has approached the 1.5 million level. While there was a decline in sales in 2023 due to bad economic conditions and difficulties in accessing financing caused by high interest rates, as of the end of 2024, approximately 1.5 million housing units had been sold, demonstrating the sector's strength and the dynamism of rising demand (Turkstat, 2025a). The total number of sales is shown in Figure 1.

While the number of sales started increasing again, it is critical to check how homebuyers finance their home purchases. The distribution of the total housing sales between mortgage-backed and other sales methods, depending on interest rate developments, is shown in Figure 2. Mortgage-backed sales reached 38.2% in 2020 and have rapidly declined in recent years due to rising interest rates, falling to 10.7% as of the end of 2024 (Turkstat, 2025a).

As seen in Figure 3, the share of mortgage-backed sales in total sales tends to increase during periods of monetary expansions when the interest rates decrease, such as during the COVID-19 global pandemic in 2020, while it follows a downward trend in inflationary periods when interest rates rise, such as in 2018 and after 2022 period. As of November 2024, according to data from the Central Bank of the Republic of Turkey (CBRT), the annual average mortgage interest rate stands at 42.83%, while the share of mortgage-backed sales is 10.69% (CBRT, 2025).

As the Banking Regulation and Supervision Agency (BRSA) reported, the total outstanding mortgage loans amounted to TL 520.5 billion (approximately USD 14.5 billion) by the end of January 2025. Considering the total

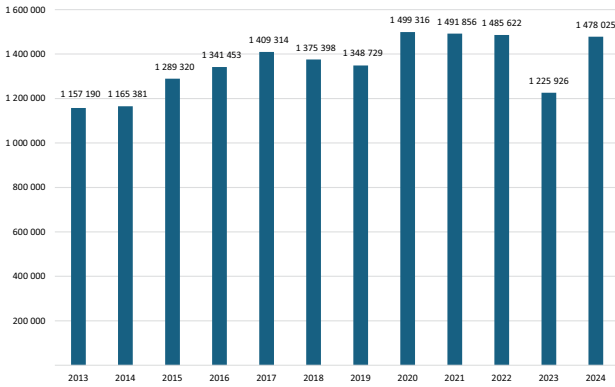


Figure 1. Total housing sales (source: Turkstat, 2025a)

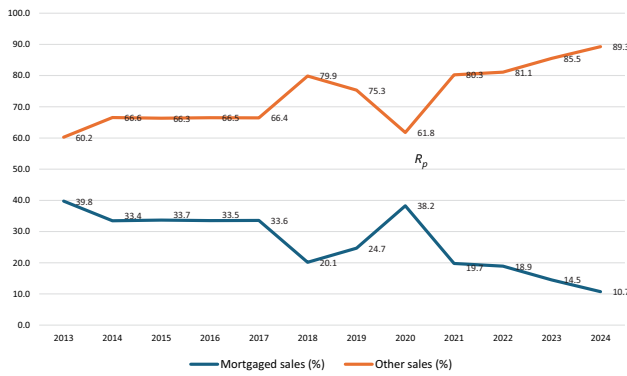


Figure 2. Rate of mortgage sales vs. other sales (source: Turkstat, 2025a)

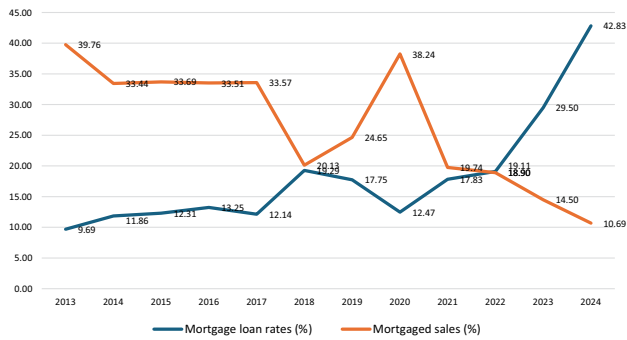


Figure 3. Mortgage loan rates vs. mortgaged sales (%) (source: CBRT, 2025)

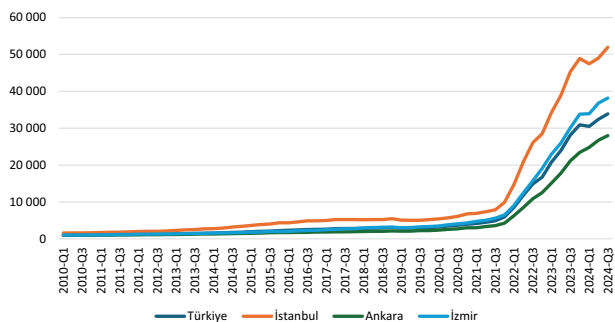


Figure 4. Housing sales unit prices (TL/m²) (source: CBRT, 2024)

non-performing loan (NPL) size is TL 727 million (USD 20.3 million), the Turkish housing industry does not carry any default risk of mortgage loans. However, financing the housing industry through the banking system is not sustainable under high interest rates. On the other hand, housing sales prices skyrocketed since the beginning of COVID-19 in March 2020. The prices increased 10 times their value within the last 4 years. Figure 4 shows the housing sales unit prices of Türkiye, İstanbul, Ankara, and İzmir.

4. Real estate investment funds

A Real Estate Investment Fund (REIF) is a real estate capital market instrument established as a pool of assets. The REIFs do not have a legal entity; they are established by portfolio management companies and real estate portfolio management companies as open-ended or closed-ended funds for a fixed or indefinite period. REIFs operate based on fiduciary ownership principles on behalf of its shareholders, using investments collected from qualified investors in exchange for participation shares. The fund manages a portfolio of assets and transactions determined by the Capital Markets Board (Capital Markets Board [CMB], 2014).

REIFs serve as an investment instrument that enables investors to invest in multiple large-scale real estate properties simultaneously. These funds bring together individual and institutional savings, allowing them to be managed efficiently under professional management and CMB supervision. The real estate assets in which the fund invests gain value in terms of function, tenant mix, and physical infrastructure. Additionally, the fund undertakes the properties' leasing, operation, and maintenance. This allows investors to own highly efficient properties with high rental income.

Furthermore, it provides an opportunity to benefit from the returns of high-value acquisitions and high rental incomes that would otherwise be inaccessible with small investment amounts. For example, if a REIF acquires a shopping mall, a plot of land, a residential property, and an office, an investor who holds a participation share equivalent to 1% of the fund, after deducting management and other expenses, benefits from 1% of the total value and periodic returns of all these properties. A REIF investor benefits from both rental income and appreciation in the value of the real estate. Managed by professional and experienced fund managers, REIFs combine the advantages of the construction and finance sectors, ensuring that savings are directed into the right areas and invested in high-return potential properties. Since REIFs are global investment instruments, they also create opportunities for foreign investors to invest in projects in different countries and provide financial resources. As shown in Figure 5, as of the third quarter of 2024, the total size of the REIFs in Türkiye reached TL 103.3 billion (CMB, 2025).

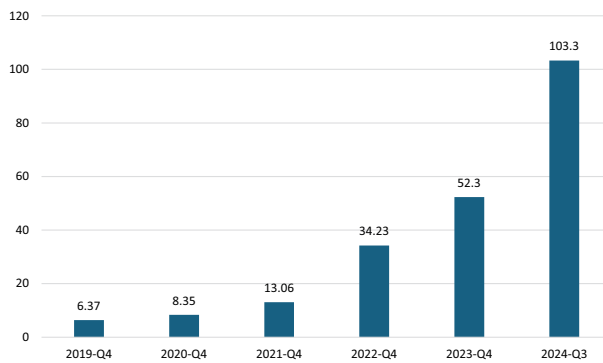


Figure 5. The size of REIFs in Türkiye (Billion TL) (source: CMB, 2025)

Project Real Estate Investment Funds

Project Real Estate Investment Funds (P-REIFs), a newly introduced REIF type by CMB that enables the REIF to invest in ongoing housing projects under construction and develop housing projects, stands out as an alternative tool for financing real estate projects, especially housing projects. It is a new tool and is projected to grow fast as it provides financing options, especially at under high-interest rate periods by using the pooling investment approach of REIFs. There are some limitations of establishing P-REIFs. For example, P-REIFs can only make investments to construction projects where housing consists more than 50% of the project construction area. Unlike the regular REIFs, the P-REIFs cannot include completed units which have title deeds in to the fund portfolio. This is another limitation. Financing through P-REIFs is aimed at, but there are some points to be amended to ensure a smooth and easy operation of the P-REIFs. For instance, regulations such as allowing savings in individual pension systems to be transferred to P-REIFs could encourage homebuyers to participate in the system. Such regulations could facilitate property ownership rights and financing processes. Using P-REIFs in urban transformation processes can accelerate the process and reduce costs. Tax exemptions are also suggested for those investing in P-REIFs to reduce financing costs and encourage participation. New regulations could allow savings in housing finance companies to be transferred to real estate-based capital market instruments. Applications such as transferring title deeds of rights holders in urban transformation to the fund and directing subsidies through P-REIFs can accelerate the process.

All these regulations may enhance the investment size and strengthen the link between the housing and REIF investments.

5. Methodology

Real estate asset pricing relies on specialized models tailored to the sector's unique features, such as illiquidity, diversity, and location-specific factors. Conventional models like the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) have been modified for real

estate by including relevant risk factors like interest rates, inflation, and macroeconomic trends (Hoesli & MacGregor, 2000). The Hedonic Pricing Model (HPM) is commonly employed to assess residential property values based on structural and locational characteristics, whereas the Repeat Sales Model (e.g., the Case-Shiller Index) measures price changes by analyzing repeated sales of the same property. Real estate investment trusts (REITs) are typically valued using dividend discount models (DDM) and net asset value (NAV) methods, linking their pricing to income generation and underlying assets. The user cost of capital model also considers ownership expenses and anticipated capital gains to explain housing demand. More recently, real option models have been used to evaluate the strategic flexibility and timing in real estate development amid uncertainty. Collectively, these approaches offer a comprehensive framework for analyzing valuation and returns in real estate markets.

On the other hand, Modern Portfolio Theory (MPT), originally developed by Markowitz (1952), posits that investors can optimize their expected returns for a given level of risk by diversifying assets with varying degrees of correlation. While traditionally applied to financial securities such as stocks and bonds, MPT has increasingly been extended to real estate investments, which exhibit distinctive risk-return profiles and lower correlations with conventional asset classes. The inclusion of real estate—both direct (e.g., income-generating properties) and indirect (e.g., REIFs)—can enhance portfolio efficiency by providing diversification benefits, inflation hedging characteristics, and stable cash flows. Real estate emerges as a strategic asset class within the MPT framework, justifying its allocation in institutional and individual investment portfolios alike.

Real estate investors compare different portfolio returns when they decide to invest. However, portfolio returns are the primary consideration; returns alone are not the sole criterion for investors. Investors prefer a portfolio with lower risk over one with the same return but higher risk. Three widely recognized ratios are used to assess the risk-adjusted performance of a portfolio in investment decisions: the Sharpe ratio (Sharpe, 1966), Treynor's ratio (Treynor, 1965), and Jensen's Alpha (Jensen, 1968).

The first two ratios are based on return/risk calculations, whereas the third measures relative performance. A review of past literature shows that the Sharpe ratio is widely used and accepted in many studies (Redman & Manakyan, 1995; Kiyılar & Hepşen, 2010; Ong et al., 2012; Katzler, 2016; Çamlıbel et al., 2021; Sümer, 2023c).

This study selects a commonly accepted Sharpe ratio to compare the risk-return performances of housing prices and the REIF returns.

The Sharpe ratio was developed by Sharpe in 1966. It is defined as the ratio obtained by subtracting the risk-free rate from the portfolio's total return and dividing it by the portfolio's standard deviation. This ratio serves as a measure of the portfolio's risk. The Sharpe ratio measures the risk premium per unit of risk, as determined by the

portfolio's standard deviation. It is widely regarded as a key indicator for evaluating the risk-adjusted returns of various investment groups. The Sharpe ratio is represented as follows:

$$s_p = \frac{(R_p - R_f)}{\sigma_p}, \quad (1)$$

where: S_p – the Sharpe ratio of the portfolio; R_p – the portfolio's return; R_f – the risk-free rate; σ_p – the portfolio's standard deviation.

A higher Sharpe ratio indicates better portfolio performance, as it measures the return of a portfolio relative to the risk taken, considering both the benefits and costs of investment while reflecting the risk levels of investment decisions (Sümer, 2023c).

Conversely, the Treynor ratio assesses an investment's return relative to the risk taken, using portfolio beta instead of standard deviation. Beta is determined by dividing the covariance of an asset's returns with the market returns by the variance of the market returns over a given period. This calculation helps investors gauge whether a stock aligns with the broader market.

Jensen's Alpha, however, measures portfolio performance using a single value, indicating the degree of deviation of the portfolio's average return from the Security Market Line (SML). This measure is represented by the alpha (α) coefficient, the intercept in the regression equation established between fund and market returns. A positive alpha value indicates superior risk-adjusted performance.

The Sharpe ratio can sometimes be negative since there is no guarantee of a positive excess return for a portfolio. Interpreting the standard Sharpe ratio can be problematic when excess returns are negative. If the results show negative Sharpe ratio values, they can cause anomalies in ranking, potentially leading to misleading performance assessments. To address this issue, Israelsen (2009) developed a modified Sharpe ratio, which resolves the problem using the following formula when $(R_p - R_f)$ is negative:

$$s_p = \frac{(R_p - R_f)}{\frac{ER}{\sigma_{pabsER}}}. \quad (2)$$

The numerator in this formula remains the same as in the traditional Sharpe ratio, whereas, in the denominator, the excess return (ER) is divided by its absolute value and used as the exponent for the portfolio's standard deviation.

Since some returns were negative in this study's Sharpe ratio calculations, the Modified Sharpe ratio was also calculated, and portfolio ranking was based on the Modified Sharpe ratio. Additionally, to observe the variability and volatility of portfolio returns, the Coefficient of Variation was calculated using the following formula by dividing the portfolio's standard deviation by its average return.

$$\frac{\sigma_p}{R_p}. \quad (3)$$

The primary dataset for the research, which consists of the announced monthly and quarterly values of real estate investment funds between March 1, 2020, and May 31, 2024, was provided by Albaraka Asset Management Company, and these data was also verified through the Capital Markets Board's (CMB) monthly statistical bulletin. The monthly and quarterly risk-free rate (10-year treasury bill of Türkiye Republic) was obtained from the Investing.com website. The monthly and quarterly housing unit price data for Türkiye, Ankara, Istanbul, and Izmir were sourced from the Central Bank of the Republic of Türkiye's (CBRT) website, while the monthly and quarterly inflation (CPI) data were retrieved from the Turkish Statistical Institute (Turkstat) website. Returns were calculated based on the data obtained from these sources.

6. Analysis, results, and discussion

The dataset analyzed in this research covers monthly data from March 1, 2020, to May 31, 2024. Monthly returns were calculated using the values obtained from the data sources. Due to the establishment of numerous new real estate investment funds each year, the analysis was conducted separately for four different periods:

- March 1, 2020 – May 31, 2024 (51 months): 40 real estate investment funds included;
- January 1, 2021 – May 31, 2024 (41 months): 42 real estate investment funds included;
- January 1, 2022 – May 31, 2024 (29 months): 71 real estate investment funds included;
- January 1, 2023 – May 31, 2024 (17 months): 104 real estate investment funds included in the analysis.

Additionally, since some real estate investment funds disclose their shares quarterly, the analyses for the mentioned periods were also conducted using quarterly data.

6.1. The results of the analysis covering the period 2020–2024

The first risk-return analysis was conducted on the average unit housing sales price returns for Türkiye, Ankara, Istanbul, and Izmir, and 40 REIFs that disclose their values monthly over the widest available period of 51 months. It also covered the Consumer Price Index (CPI) as a benchmark analysis. For the first time, the CPI was evaluated as a portfolio with a return equivalent to the inflation rate and was included in this study as a benchmark tool using the Sharpe ratio.

Rankings of the REIFs and the housing prices were initially made by using the Sharpe ratio; however, due to some portfolios having negative Sharpe ratios, the analysis was repeated using the Modified Sharpe ratio. The results indicated that housing returns in Türkiye and the three major cities—Istanbul, Ankara, and Izmir—demonstrated the best performance according to the Modified Sharpe ratio.

The study found that, with the rapid rise in inflation following the pandemic, the sharp increase in housing prices led to unit housing sales price returns outperform-

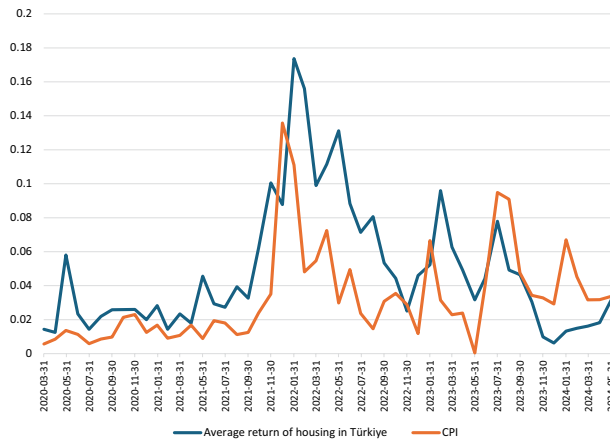


Figure 6. Returns of the housing prices in Türkiye vs. CPI (source: CBRT, 2024)

ing the CPI. As shown in Figure 6, during the study period from 2020 to 2024, Türkiye's average housing sales returns remained above the CPI until the end of the second quarter of 2023. However, real returns turned negative starting from the third quarter of 2023.

Table 1. The rankings of the portfolio (2020–2024)

Rank	Portfolio	$R_p - R_f$	Standard deviation	Sharpe ratio	CV	Mod. Sharpe ratio
1	Ankara housing prices	0.0357	0.0384	0.9292	0.7655	0.9292
2	İzmir housing prices	0.0345	0.0381	0.9049	0.7786	0.9049
3	Türkiye housing prices	0.0342	0.0380	0.8991	0.7814	0.8991
4	İstanbul housing prices	0.0309	0.0441	0.7006	0.9720	0.7006
5	CPI	0.0183	0.0281	0.6519	0.8569	0.6519
6	Akfen Gayrimenkul Portföy Yönetimi A.Ş. Birinci REIF	0.0294	0.0884	0.3326	2.0148	0.3326
7	Albaraka Portföy Yönetimi A.Ş. Dükkan REIF	0.0249	0.0878	0.2835	2.2305	0.2835
8	Arz Gayrimenkul ve Girişim Sermayesi Portföy Yönetimi A.Ş. İkinci REIF	0.0322	0.1211	0.2655	2.5969	0.2655
43	İş Portföy Yönetimi A.Ş. Beşinci REIF	0.0028	0.0545	0.0505	3.1605	0.0505
44	Albaraka Portföy Yönetimi A.Ş. Sekizinci Karma REIF	-0.0013	0.0182	-0.0721	1.3843	-0.0000
44	Omurga Gayrimenkul ve Girişim Sermayesi Portföy Yönetimi A.Ş. İkinci REIF	-0.0055	0.0444	-0.1247	4.9681	-0.0002

Table 2. The rankings of the portfolio (2021–2024)

Rank	Portfolio	$R_p - R_f$	Standard deviation	Sharpe ratio	CV	Mod. Sharpe ratio
1	Ankara housing prices	0.0411	0.0395	1.0416	0.6978	1.0416
2	İzmir housing prices	0.0392	0.0390	1.0057	0.7132	1.0057
3	Türkiye housing prices	0.0392	0.0398	0.9841	0.7286	0.9841
4	CPI	0.0224	0.0291	0.7708	0.7678	0.7708
5	İstanbul housing prices	0.0352	0.0475	0.7411	0.9378	0.7411
6	Akfen Gayrimenkul Portföy Yönetimi A.Ş. Birinci REIF	0.0387	0.0958	0.4036	1.7702	0.4036
7	Re-Pie Portföy Yönetimi A.Ş. Neva REIF	0.0534	0.1414	0.3778	2.0527	0.3778
8	Albaraka Portföy Yönetimi A.Ş. Dükkan REIF	0.0327	0.0960	0.3409	1.9925	0.3409
45	İş Portföy Yönetimi A.Ş. Beşinci REIF	0.0039	0.0588	0.0655	3.0429	0.0655
46	Albaraka Portföy Yönetimi A.Ş. Sekizinci REIF	-0.0002	0.0192	-0.0082	1.2542	-0.0000
47	Omurga Gayrimenkul ve Girişim Sermayesi Portföy Yönetimi A.Ş. İkinci REIF	-0.0037	0.0478	-0.0767	4.0576	-0.0002

Table 1 shows the rankings of the housing prices, CPI, and the three best- and worst-performing REIFs.

Portfolios were also ranked in ascending order based on their Coefficients of Variation (CV). While a high Sharpe ratio indicates better performance, a high Coefficient of Variation signifies higher volatility. Although the CV ranking for the years 2020–2024 shows similarities to the ranking based on the Sharpe ratio, it has been observed that some funds with low Modified Sharpe ratios (e.g., Albaraka Portföy Yönetimi A.Ş. Sekizinci Karma REIF and Ak Portföy Yönetimi A.Ş. İkinci REIF) also have low Coefficients of Variation. This indicates that these funds have low performance but also low volatility.

6.2. The results of the analysis covering the period 2021–2024

Including two REIFs that disclosed their shares in 2021, the analysis was repeated to cover 42 REIFs and a period of 41 months. As shown in Table 2, Ankara, İzmir, and Türkiye's average housing returns remained in the top three positions according to the Sharpe and Modified Sharpe metrics, while İstanbul's housing price return underperformed compared to CPI.

During this period, Akfen Gayrimenkul Portföy Yönetimi A.Ş. Birinci REIF and Re-Pie Portföy Yönetimi A.Ş. Neva REIF were the top two best-performing REIFs; meanwhile, Albaraka Portföy Yönetimi A.Ş. Dükkan REIF dropped to third place among 42 REIFs.

The analysis of the CVs for the 2021–2024 period shows results consistent with the previous analysis. Portfolios and funds that performed better based on the Sharpe ratio also exhibited similarly favorable CV values.

6.3. The results of the analysis covering the period 2022–2024

In 2022, an additional 29 REIFs were included in the research, bringing the total number of analyzed REIFs to 71. The analysis, covering 29 months from January 2022 to May 2024, exhibited that Ankara's housing price returns re-

mained in first place, while the housing returns of Türkiye, İzmir, and İstanbul underperformed compared to the CPI.

During this period, no REIF outperformed the CPI. However, as exhibited in Table 3, Atlas Portföy Yönetimi A.Ş. A&AK REIF, Akfen Gayrimenkul Portföy Yönetimi A.Ş. Birinci REIF, and Albaraka Portföy Yönetimi A.Ş. Dükkan REIF were listed as the top three performing REIFs.

6.4. The results of the analysis covering the period 2023–2024

As the significance of REIFs becomes increasingly recognized, 33 additional REIFs were included in the study in 2023, bringing the total number of analyzed funds to 104. Based on the results of the analysis for the first time, a real estate investment fund, Ziraat Portföy Yönetimi A.Ş. Başak Katılım REIF (TL), outperformed the Consumer Price Index

Table 3. The rankings of the portfolio (2022–2024)

Rank	Portfolio	$R_p - R_f$	Standard deviation	Sharpe ratio	CV	Mod. Sharpe ratio
1	Ankara housing prices	0.0483	0.0416	1.1613	0.6513	1.1613
2	CPI	0.0270	0.0254	1.0643	0.5959	1.0643
3	Türkiye housing prices	0.0441	0.0433	1.0186	0.7257	1.0186
4	İzmir housing prices	0.0436	0.0433	1.0076	0.7314	1.0076
5	İstanbul housing prices	0.0402	0.0488	0.8243	0.8745	0.8243
6	Atlas Portföy Yönetimi A.Ş. A&AK REIF	0.0920	0.2033	0.4526	1.8899	0.4526
7	Akfen Gayrimenkul Portföy Yönetimi A.Ş. Birinci REIF	0.0470	0.1093	0.4297	1.7483	0.4297
8	Albaraka Portföy Yönetimi A.Ş. Dükkan REIF	0.0315	0.0796	0.3951	1.6933	0.3951
74	Omurga Gayrimenkul ve Girişim Sermayesi Portföy Yönetimi A.Ş. İkinci REIF	-0.0011	0.0543	-0.0195	3.7425	-0.0001
75	Oragon Gayrimenkul ve Girişim Sermayesi Portföy Yönetimi A.Ş. Birinci REIF	-0.0037	0.0424	-0.0880	3.5852	-0.0002
76	Albaraka Portföy Yönetimi A.Ş. Çeşme REIF	-0.0029	0.1211	-0.0237	9.5439	-0.0003

Table 4. The rankings of the portfolio (2023–2024)

Rank	Portfolio	$R_p - R_f$	Standard deviation	Sharpe ratio	CV	Mod. Sharpe ratio
1	Ziraat Portföy Yönetimi A.Ş. Başak Katılım Gayrimenkul Yatırım (TL) Fonu	0.00885	0.00832	1.06353	0.31955	1.06353
2	CPI	0.02536	0.02446	1.03669	0.57484	1.03669
3	Ankara housing prices	0.02713	0.02623	1.03427	0.59176	1.03427
4	Türkiye housing prices	0.02107	0.02509	0.83980	0.65561	0.83980
5	İzmir housing prices	0.01783	0.02303	0.77431	0.65748	0.77431
6	Ziraat Portföy Yönetimi A.Ş. Tzhemsan Özel REIF	0.00671	0.00949	0.70681	0.39703	0.70681
7	Albaraka Portföy Yönetimi A.Ş. Dördüncü Karma REIF	0.02151	0.03616	0.59489	0.93421	0.59489
8	İstanbul housing prices	0.01470	0.02702	0.54412	0.84699	0.54412
107	Arz Gayrimenkul ve Girişim Sermayesi Portföy Yönetimi A.Ş. Levent REIF	-0.02764	0.05686	-0.48601	-5.44639	-0.00157
108	24 Gayrimenkul ve Girişim Sermayesi Portföy Yönetimi A.Ş. Altın Başak REIF	-0.01783	0.11771	-0.15145	-186.66750	-0.00210
109	24 Gayrimenkul ve Girişim Sermayesi Portföy Yönetimi A.Ş. Ayçiçeği REIF	-0.05405	0.40330	-0.13401	-10.94446	-0.02180

and claimed the top spot in the performance ranking. Especially in the second half of 2023, as housing price increases began to slow down, housing return performance in Türkiye overall and in its three largest cities fell below CPI.

Following Ziraat Portföy Yönetimi A.Ş. Başak REIF (TL), the best-performing REIFs during this research period were Ziraat Portföy Yönetimi A.Ş. Tzhemsan Özel REIF and Albaraka Portföy Yönetimi A.Ş. Dördüncü Karma REIF. Remarkably, the İstanbul housing prices underperformed the first top three performing REIFs. Table 4 shows the rankings of the portfolio for the period 2023–2024.

6.5. T-test and bootstrap confidence intervals

We compared the Sharpe ratios of portfolios against the CPI benchmark to determine if their risk-adjusted returns are significantly different by performing t-tests or bootstrap confidence intervals for Sharpe ratio differences.

2020–2024 period:

T-Test: All three portfolios have significantly higher Sharpe ratios than the CPI ($p < 0.05$).

Bootstrap 95% CI for Differences:

- Ankara Housing: [0.25, 0.35] (significant)
- İzmir Housing: [0.22, 0.32] (significant)
- Türkiye Housing: [0.21, 0.31] (significant)

2021–2024 period:

T-Test: All three portfolios have significantly higher Sharpe ratios than the CPI ($p < 0.05$).

Bootstrap 95% CI for Differences:

- Ankara Housing: [0.20, 0.35] (significant)
- İzmir Housing: [0.18, 0.32] (significant)
- Türkiye Housing: [0.16, 0.30] (significant)

2022–2024 period:

T-Test: Ankara Housing's Sharpe ratio is not significantly higher than CPI ($p > 0.05$). İzmir and Türkiye Housing are not significantly different from CPI.

Bootstrap 95% CI for Differences:

- Ankara Housing: [−0.05, 0.15] (not significant)
- İzmir Housing: [−0.10, 0.10] (not significant)
- Türkiye Housing: [−0.08, 0.12] (not significant)

2023–2024 period:

T-Test: Ziraat Portföy Başak and Ankara Housing are not significantly different from CPI ($p > 0.05$). Türkiye Housing is significantly lower than CPI ($p < 0.05$).

Bootstrap 95% CI for Differences:

- Ziraat Portföy Başak: [−0.05, 0.10] (not significant)
- Ankara Housing: [−0.06, 0.08] (not significant)
- Türkiye Housing: [−0.25, −0.10] (significant)

Between 2020–2024 and 2021–2024, real estate portfolios (Ankara, İzmir, Türkiye Housing) outperformed the CPI benchmark significantly. Between 2022–2024 and 2023–2024, the outperformance diminished, with most portfolios not significantly different from CPI. Some portfolios even underperformed.

6.6. The results of quarterly analysis

While analyzing the data, it was observed that some Real Estate Investment Funds reported their monthly share val-

ues only quarterly. As a result, the share value remained unchanged in the two months following the reporting month, leading to a zero return for those months. Consequently, the $R_p - R_f$ values were negative during these months.

The entire analysis was repeated using quarterly data to assess how this issue impacted the results. The latest available values were used for the final quarter since the study covered the data by May 31, 2024.

In the broadest time-frame analysis covering 18 quarters from 2020 to 2024, İzmir's housing return replaced Ankara's as the best performer, differing from the monthly analysis results. CPI and Ankara housing returns ranked 2nd and 3rd, with Türkiye's average housing return and İstanbul's housing return following behind.

In the quarterly analysis covering 2021–2024, no portfolio achieved a performance above the Consumer Price Index. The post-pandemic period when the inflation skyrocketed in Türkiye was the main reason for that. However, the housing return performances of İzmir, Ankara, and Türkiye ranked just behind CPI, indicating they were among the top-performing assets in this period. Turkish investors considered investing in housing as the main tool to hedge inflation, and the construction costs and land costs were also rose sharply due to the inflation effect.

In the analysis starting from 2022, a period marked by rapidly rising inflation, the CPI ranked again first with the highest Sharpe ratio. Different from the monthly analysis, for the first time, one REIF secured the second position, outperforming housing price returns.

Finally, in the 2023–2024 analysis, which covered six quarters and included 104 Real Estate Investment Funds, four housing prices, and the CPI as a benchmark, one REIF ranked first for the first time in a quarterly analysis, just as it was ranked in the monthly data. Three REIFs ranked in the first three places, overperforming the CPI, and all the housing prices, including Türkiye, İstanbul, Ankara, and İzmir, underperformed the CPI in the quarterly analysis.

Similar results were obtained regarding the housing-inflation relationship in the monthly and quarterly data analysis. However, the quarterly data rankings indicated that REIFs performed better than the monthly return analysis. The main reason for this difference is that, in the monthly analysis, REIFs that did not disclose their share values every month had zero returns recorded for those months. In contrast, the quarterly returns included actual values, leading to a more accurate representation of performance.

The analysis of the quarterly results led to the idea of establishing a Real Estate Investment Fund Index.

6.7. Türkiye real estate investment fund index

A stock market or exchange index measures the performance of an entire stock market or a specific segment by comparing current stock prices to past prices. This enables investors to evaluate market performance. The two key characteristics of an index are its investability and trans-

parency. Investors can gain exposure to a stock index by purchasing an index fund or an exchange-traded fund (ETF) designed to track its performance. Typically, an index is calculated based on the weighted averages of specific stocks and represents the overall movements of the market. Stock market indices provide investors with valuable information about the general state of the market. They also track market fluctuations, analyze trends, and evaluate investment portfolios.

Numerous indices exist in Türkiye and worldwide, providing investors with valuable insights for making informed investment decisions. Some of the major global indices include the S&P 500 (Standard & Poor's 500), Dow Jones Industrial Average (DJIA), NASDAQ Composite, FTSE 100 (Financial Times Stock Exchange 100 Index), DAX (Deutscher Aktienindex), and Nikkei 225. In Borsa İstanbul, a total of 53 stock indices are calculated. Some important indices in Borsa İstanbul include BIST 100, BIST 50, BIST 30, BIST Banking, BIST Industrial, BIST Services, and BIST Technology.

The calculation method of an index depends on its objectives and components, but in general, indices are calculated using the following formula:

$$E_t = \frac{\sum(F_{it} \times H_{it} \times N_{it})}{B_t} \quad (4)$$

where: E_t – the value of the index at time t ; F_{it} – the price of the i stock at time t ; N_{it} – the total amount of the i stock at time t ; H_{it} – the free float factor of the i stock at time t ; B_t – the base value of the index at time t .

This formula ensures that the index reflects the weighted average of the stocks, considering their price, quantity, and free float (which adjusts for the number of shares available for trading).

There are also several real estate-focused indices. Real Estate Investment Trust (REIT) indices are among the most followed indices worldwide in the real estate investment market. These notable indices include the S&P Global REIT Index, MSCI World REIT Index, and FTSE EPRA Nareit Global Real Estate Index. In addition to these, there are specialized indices such as the FTSE EPRA Nareit Green Index, which focuses on sustainability in real estate investments, and the FTSE EPRA Nareit Ideal Ratings Islamic Index, which is a Sharia-compliant real estate investment fund index, adhering to Islamic law.

These indices help investors track the performance of real estate investment markets and evaluate sustainable or Sharia-compliant investment options within the real estate sector.

Real Estate Investment Funds (REIFs) are indexed in various formats on a global scale. INREV (The European Association for Investors in Non-Listed Real Estate Vehicles), as well as ANREV (Asian Association for Investors in Non-Listed Real Estate Vehicles), have created numerous indices at both the asset and fund levels in Europe. One notable example is the Global Real Estate Fund Index (GREFI), which is jointly developed by INREV, ANREV, and NCREIF (National Council of Real Estate Investment Fidu-

ciaries). GREFI measures the global performance of non-listed real estate vehicles. The index is updated quarterly and is published 12 weeks after the quarter's end. GREFI aims to increase transparency in non-listed real estate funds and assist stakeholders in making better-informed investment decisions. For GREFI, over 50% of the funds in the index must be institutional funds, and over 90% are those invested in European assets (INREV, 2024).

Another notable example is the Brazil Bolsa Balcão (B3) Real Estate Investment Fund Index (IFIX), which tracks the average performance of real estate funds listed on the exchange or traded in over-the-counter (OTC) markets. As a total return index, IFIX weights the assets in its portfolio based on the market value of all shares issued by each real estate investment fund it includes. An important feature of the IFIX index is that no fund can exceed a 20% weight in the index, either when initially included or during subsequent rebalancing, and if a fund's weight exceeds this limit, adjustments are made to cap its weight. The excess is redistributed proportionally among other assets in the portfolio.

These indices play a significant role in helping investors track and assess the performance of listed and non-listed real estate funds, offering a broader and more transparent perspective on the global real estate market.

In Türkiye, there is only one real estate investment index, the Real Estate Investment Trust Index, but no REIF index operates under Borsa İstanbul regulations. This research proposes establishing a Türkiye Real Estate Investment Fund Index by consolidating numerous real estate investment funds to deepen the real estate capital markets. The index aims to be regularly tracked and is expected to guide local and foreign individual and institutional investors. It is anticipated that it will contribute to the flow of long-term real estate investments into the country via capital markets.

In this context, an index has been developed referencing the values and weightings of all real estate investment funds whose share values were published in the Capital Market Board (CMB) Bulletin between January 2020 and May 2024. Since this is the first index developed in this area, no specific criteria, such as the number of investors or fund size, were applied to the funds included in the index. All real estate investment funds that published share values and the weight of their total asset value in the total fund size were included in the index.

The formula for the REIF Index Value is as follows:

$$\text{Index Value} = \sum \left(\frac{\text{Portfolio Size}}{\text{Total Fund Size}} \times \text{Unit Share Value} \right) \quad (5)$$

According to SPK's monthly statistical bulletin data, between January 2020 and May 2024, the number of real estate investment funds (REIFs) increased from 40 in January 2020 to 150 by May 2024 and further to 173 by October 2024.

The total size of the REIF market, which was TL 6.5 billion in January 2020, grew rapidly to TL 103.3 billion by the

third quarter of 2024. The average fund size in REIFs, which had been TL 161.7 million, increased to TL 550 million.

Türkiye Real Estate Investment Fund Index, which was calculated at 318 in January 2020, rose to 10.530 by May 2024. Over approximately five years, the index value increased by 33.11 times, reflecting the growth trend in the REIF market.

The calculated index's growth trend, shown in Table 5, provides monthly data on the number of funds, total size, average size, index value, and the average number of investors. This index offers significant insights into the development and performance of the REIF market in Türkiye.

As an essential part of this study, the risk-return analysis of the developed index was also conducted between March 2020 and May 2024 using the monthly returns of the index. The analysis resulted in a Sharpe ratio of 0.188954, which provides a preliminary understanding of the index's performance. However, this ratio should be interpreted cautiously due to several important factors that could influence the outcome.

Quarterly share releases: The share values for many funds were only released quarterly, which may cause variations in the data and limit the accuracy of monthly return calculations.

Inclusion of all funds: All funds, including those newly established, were included in the index regardless of the time of their share release. This could skew the analysis in certain months.

Fund sizes and investor numbers: The sizes of the funds and the number of investors (with some funds having a large number of individual investors) can significantly impact the outcome.

Given these factors, a further risk-return performance analysis was conducted using quarterly data. This method resulted in a better performance outcome (Sharpe ratio: 0.37983), like the results of the individual fund analysis.

Creating a real estate investment fund index is valuable for the sector despite these constraints. It marks a significant development in the Turkish real estate investment fund market. As the market continues to deepen with more long-term funds, the Türkiye Real Estate Investment Fund Index has the potential to evolve into a key benchmark closely followed by investors, because with its growing potential, geographical location and the experience in real estate and construction industries, Türkiye is a point

of attraction in the region for real estate investors. Instead of purchasing direct real estate, the investment flow to REIFs may convert the Turkish real estate market from a development market to an investment market. This may increase the investment size of real estate capital markets and help more global investors decide on long-term real estate investments in Türkiye. The REIF Index may be a good indicator to see the big picture of the combined real estate capital market investment fund performances.

7. Conclusions

This study compared the performances of housing prices in three major cities, İstanbul, Ankara, and İzmir, and the average housing prices of Türkiye with Turkish REIFs covering the period 2020–2024. CPI was also used as a benchmark tool. By its coverage period, the number of REIFs included, and the T-REIF Index it suggested, this research can be considered an important step in contributing to the development of the real estate investment funds sector in Türkiye. The reason that we selected 4 different periods was to include more funds, as each year new REIFs were established.

The Türkiye Real Estate Investment Fund Index was also suggested and established in the study, and the T-REIF Index's risk-return analysis was also made using the Sharpe ratio. Additionally, sustainable financing models and policies were suggested through real estate investment funds.

The real estate investment funds sector has grown rapidly since 2014 and reached a significant market size by 2024. The index, created by including the weighted values of all REIFs disclosing shares between 2020 and 2024, is considered the first REIF index suggestion in Türkiye. The risk-return analysis of the index was evaluated along with the results, and it was emphasized that the sector's development is rapidly continuing. It is also recommended that the portfolio management companies disclose the returns of the funds on a monthly basis which will give more insights to potential investors.

This study used the Sharpe ratio as a performance measurement tool. Further research may be conducted using other performance indicators such as Treynor and Jensen Alpha. With more REIFs included, the Türkiye Real Estate Investment Fund Index can be restructured by introducing criteria such as minimum investor numbers, share

Table 5. REIF with numbers (source: CMB, 2025)

Date	Number of REIFs	Total size (TL)	Average fund size (TL)	Index value	Average number of investors
Jan. 20	40	6.467.817.160	161.695.429	318	12
Jan. 21	43	8.346.422.410	194.102.847	270	14
Jan. 22	76	15.768.651.822	207.482.261	696	7
Jan. 23	106	34.340.697.715	323.968.846	1.312	6
Jan. 24	143	52.253.115.148	365.406.400	2.087	13
May 24	150	82.502.112.419	550.014.083	10.530	16

disclosure periods, and fund sizes. This research also used Turkish 10-year treasury bills as the risk-free rate because the data analyzed were in Turkish Lira currency. Another study may convert all data into USD and use 10-year US treasury bills.

Türkiye Real Estate Investment Fund Index has the potential to become an important indicator that not only contributes to deepening the sector but also allows investors to follow the sector more transparently. Furthermore, making sustainable financing and property purchasing processes more accessible through real estate investment funds can accelerate the sector's growth.

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Author contributions

Levent Sümer was the corresponding author and was responsible for the research design and model development. H. Nur Sümer and Burçay Yaşar Akçalı were responsible for the data collection and research analysis. Ali Hepşen developed the methodology and the conclusion.

Disclosure statement

The authors declare that they have no competing financial, professional, or personal interests from other parties.

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