GREIX

Residential real estate as an investment: Regional diversification pays off

Overview

- Since 1995, apartment prices in German cities have moved through three distinct market phases: a prolonged sideways phase until the end of 2009, a boom until the end of 2021, and a correction since then. Behind the aggregate, however, local price paths differ substantially.
- Based on GREIX data, we analyze nominal price growth and its volatility. The analysis is limited to capital gains and uses annualized rates of change based on a four-quarter average.
- The market-weighted portfolio is already well positioned in historical risk-return space, but it remains visibly below the efficient frontier. At comparable risk, a roughly 0.35 percentage point higher annual price increase would have been attainable historically. Over 30 years, this adds up to a final value that is more than 27 percentage points higher.
- Spatial diversification is beneficial in all market phases considered. At the same time, the composition of efficient portfolios changes over time, because different locations contribute to efficiency in different phases. This suggests that portfolio decisions should explicitly account for the prevailing market regime.

1 Introduction

This report asks whether diversifying residential real estate investments across German cities would historically have improved the risk-return profile relative to a plausible market benchmark. Residential real estate is not only a place to live; for many households it is also the largest single asset on the balance sheet. Historically, real estate has generated attractive long-run returns (Jordà et al., 2019). Yet unlike equities or bonds, real estate investment is always tied to a specific location. Most investors therefore hold highly concentrated portfolios that depend on only a few local markets. One important driver is so-called home bias: investors systematically buy in their home region, regardless of whether this is optimal from a risk-return perspective (Wright & Yanotti, 2019). Pelizzon & Weber (2008) show that household portfolios with a high share of owner-occupied housing are systematically inefficient because concentration in a single property distorts the risk profile of the overall portfolio.

The benchmark is a market-weighted portfolio whose city weights reflect their relative shares in transaction volume. We compare this benchmark with optimized portfolios based on a classical mean-variance approach in the sense of Markowitz (1952). The practical question is therefore not only whether diversification across cities would have outperformed an individual city, but also whether it would have improved on a plausible market benchmark.

The focus is on nominal price growth for apartments, excluding rental income and transaction costs. This is a transparent, though simplified, perspective. Each city is treated as an already internally diversified local real estate portfolio. This assumption is stronger than reality, because substantial heterogeneity exists within cities by location, quality, and property mix. For the question addressed in this report, however, it is a useful first step because it makes differences in price cycles and covariances between cities visible. A more granular analysis is left for future work.

For the analysis, we use GREIX data[1] for apartments in German cities since 1995. Amaral et al. (2025) and Kaas et al. (2024) document that real estate returns can diverge substantially across regions – precisely this dispersion is what creates scope for spatial diversification. In the German market, three clearly distinct market phases emerge: a long sideways and weak phase until the end of 2009, a pronounced boom until the end of 2021, and a correction and sideways movement since then. This phase

[1]We use the data vintage from February 5, 2026. The data can be downloaded directly from the website. Data collection and methodology are described in the accompanying working paper by Amaral et al. (2023).

structure makes it possible to examine whether efficient portfolios remain stable or whether their composition shifts with the market cycle.

The analysis yields three central findings. First, the market-weighted portfolio provides a meaningful starting point: it is already well positioned in risk-return space. Second, the efficient frontier shows that even relative to this benchmark there was scope for optimization. Third, the composition of efficient portfolios is not stable; it shifts markedly with the market regime. Investors who extrapolate from only one upswing or downturn risk misallocations once market conditions change.

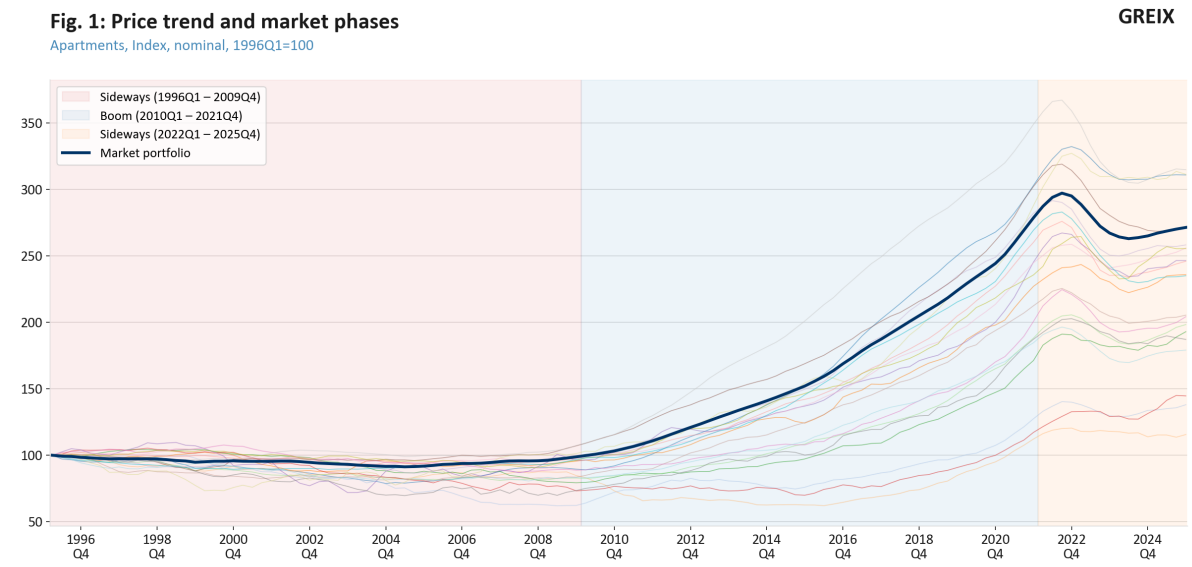
2 Historical price developments across German cities

Figure 1 shows the development of the GREIX series for apartments since 1996. The trajectory falls clearly into three phases. From the mid-1990s to the end of 2009, the aggregate price level moved sideways or declined slightly. This was followed by a broad-based upswing that drove apartment prices sharply higher until the end of 2021. Since 2022, a correction and sideways phase has dominated.

The solid line shows the market-weighted portfolio across the cities used in this report. In what follows, it serves as the benchmark against which the efficient portfolios are assessed.

At the same time, the aggregate masks substantial local heterogeneity. Some cities recorded strong gains during the boom and then declined noticeably; others developed more smoothly or caught up only later. From an investor's perspective, this heterogeneity is central: focusing only on cities that performed particularly well ex post can easily understate how strongly winner profiles depend on the market phase considered.

For the following analysis, we therefore examine not only the level of price growth, but also its volatility. The returns used here refer exclusively to capital gains. They answer the question of how local apartment markets behaved as price index series, not how high a full total real estate return including rental income would have been.



Notes: The figure shows the GREIX price indices for apartments based on a four-quarter average. The solid line marks the market-weighted portfolio across the selected cities. The shaded areas indicate the market phases 1995Q4–2009Q4, 2010Q1–2021Q4, and 2022Q1–2025Q4. Sources: GREIX, own calculations.

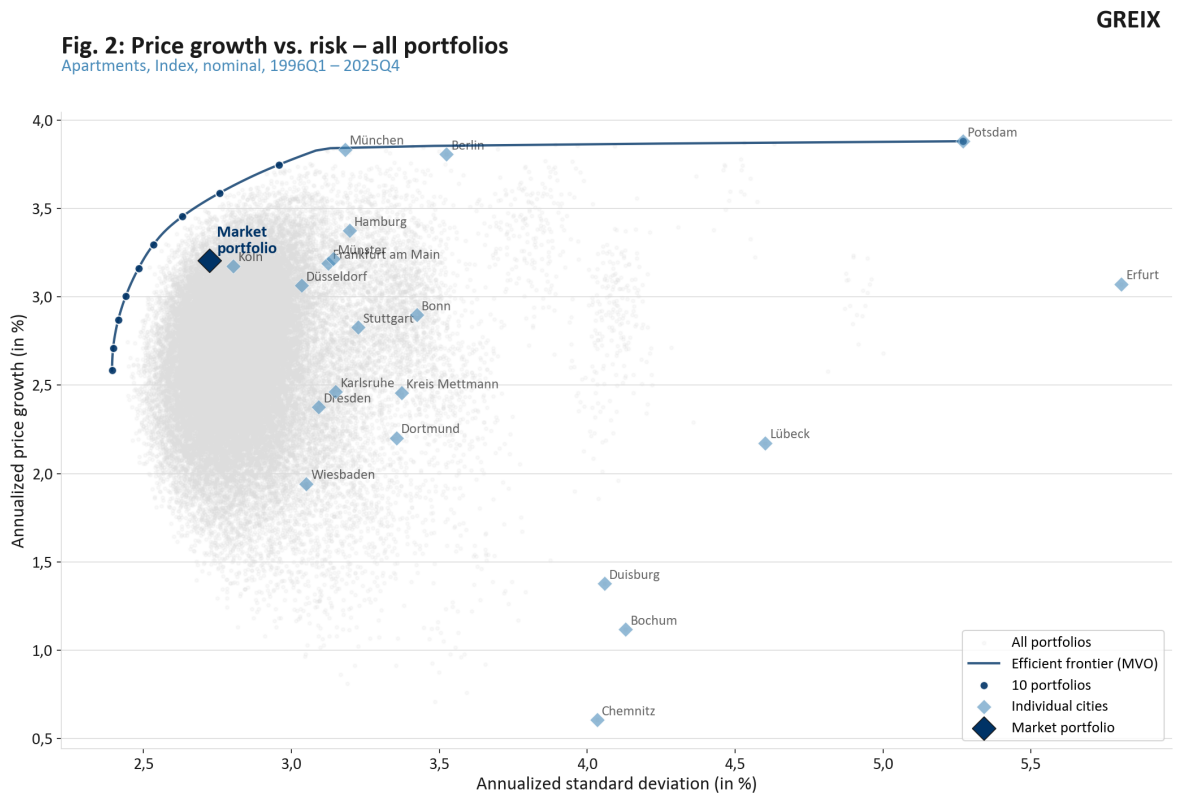
3 Spatial diversification improves the risk-return trade-off

To evaluate spatial diversification systematically, we assign two measures to each city: average annualized price growth and the corresponding annualized standard deviation. In other words, we examine first how strongly prices rose on average and second how much this development fluctuated. On this basis, we construct efficient portfolios in the sense of Markowitz (1952). The basic principle is intuitive: if two cities do not move in lockstep, a mixed portfolio of the two fluctuates less than either city on its own. The optimization uses this effect systematically and searches for combinations that minimize risk for a given return. The result is the efficient frontier: it shows all portfolios that cannot be improved further without either taking on more risk or giving up return. The portfolios are long-only, weights sum to 100 percent, short sales are excluded, and transaction costs are not taken into account.

Figure 2 shows the cities, all feasible portfolios, and the efficient frontier for the full period 1995Q4–2025Q4. Two findings stand out. First, many mixed portfolios lie to the left of the individual cities, that is, at lower risk. This cloud already shows that spatial diversification can smooth part of local price fluctuations. Second, the comparison with the market portfolio is instructive: with annualized price growth of around 3.21 percent and risk of 2.72 percent, it is already well positioned in risk-return space, but remains visibly below the efficient frontier.

The key result comes from the efficient frontier: at practically the same risk as the market portfolio, higher price growth would have been attainable historically. Annualized price growth is around 3.56 percent. Over a period of 30 years, this would correspond to a final value that is more than 27.5 percentage points higher. The central message is therefore that optimization could have paid off even relative to a broadly diversified market portfolio. However, this efficient frontier is an ex post construction; in practice, the covariance structure is not known in advance, so the improvement that could actually have been achieved is likely to be smaller than the historical record suggests.

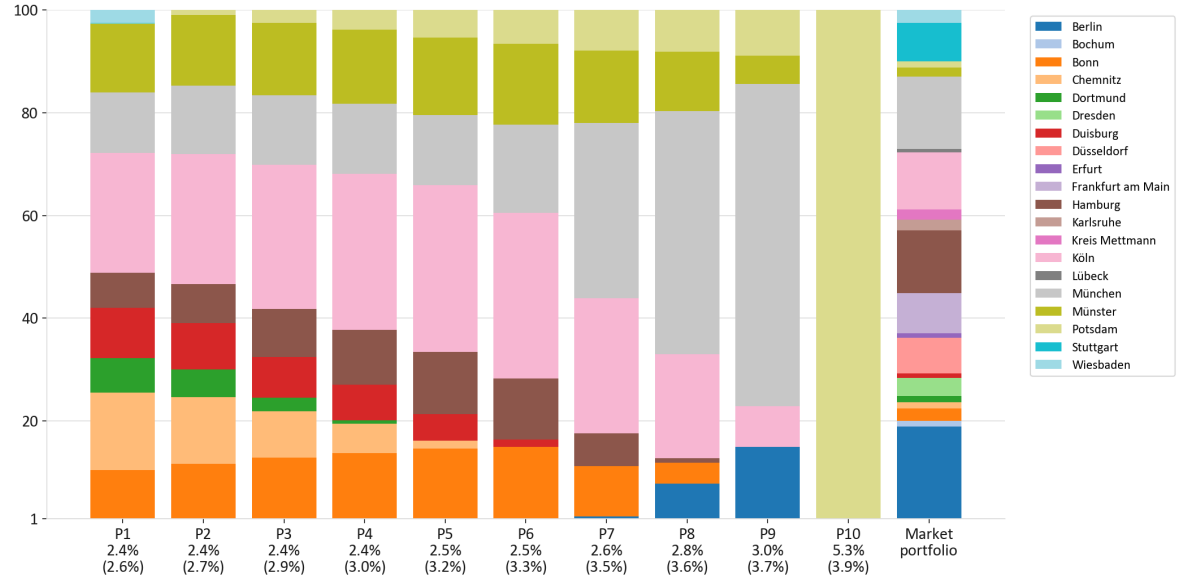
Figure 3 shows how weights change along the efficient frontier. At the low-risk end, broadly diversified portfolios dominate, with relatively high shares of Cologne, Münster, and Chemnitz. As the target return increases, weights gradually shift toward Munich, Potsdam, and Berlin; at the upper end, the efficient portfolio becomes considerably more concentrated. The market portfolio is therefore a meaningful starting point, but not automatically the historically most efficient portfolio.



Notes: The figure shows individual cities, all feasible long-only portfolios, and the resulting efficient frontier. Return is defined as annualized nominal price growth, and risk as annualized standard deviation. The market-weighted portfolio is marked as the benchmark. The analysis is limited to capital gains and assumes no short sales and no transaction costs. Sources: GREIX, own calculations.

Fig. 3: Portfolio weights – efficient portfolios vs. market portfolio GREIX

Apartments, City weights (in %), 1996Q1 – 2025Q4



Notes: The bars show the weights of the ten selected portfolios on the efficient frontier as well as of the market-weighted portfolio. The x-axis shows the annualized yearly growth rates and standard deviations, respectively, with standard deviations shown in parentheses. The underlying portfolios are constructed as long-only portfolios and are based exclusively on capital gains. Sources: GREIX, own calculations.

4 Efficient portfolios change with the market regime

The analysis over the full period smooths over very different market environments. A portfolio that appears efficient over three decades does not necessarily perform well in each individual phase. Figure 4 shows that the position of cities in risk-return space shifts markedly across market phases.

The early phase 1995Q4–2009Q4 is characterized by low to slightly negative price growth, while overall risk is lower as well. The contrast between the subsequent boom and correction phases is especially clear. In the 2010Q1–2021Q4 phase, annualized price growth is high almost across the board, while risks remain moderate. In the phase since 2022, the picture reverses: several previously high-growth markets such as Munich, Stuttgart, and Hamburg show clearly negative price growth, while individual cities such as Duisburg, Dortmund, and Chemnitz continue to post positive nominal gains. This already shows that a location that appears strong ex post does not necessarily emerge as a winner in each phase of the market cycle.

Figure 5 translates these differences into efficient portfolios. In the 1995–2009 phase, the efficient frontier is relatively flat and close to zero; diversification mainly reduces risk, but generates only small return gains. The efficient frontier of the 2010–2021 boom lies clearly above those of the other phases: high price growth was attainable

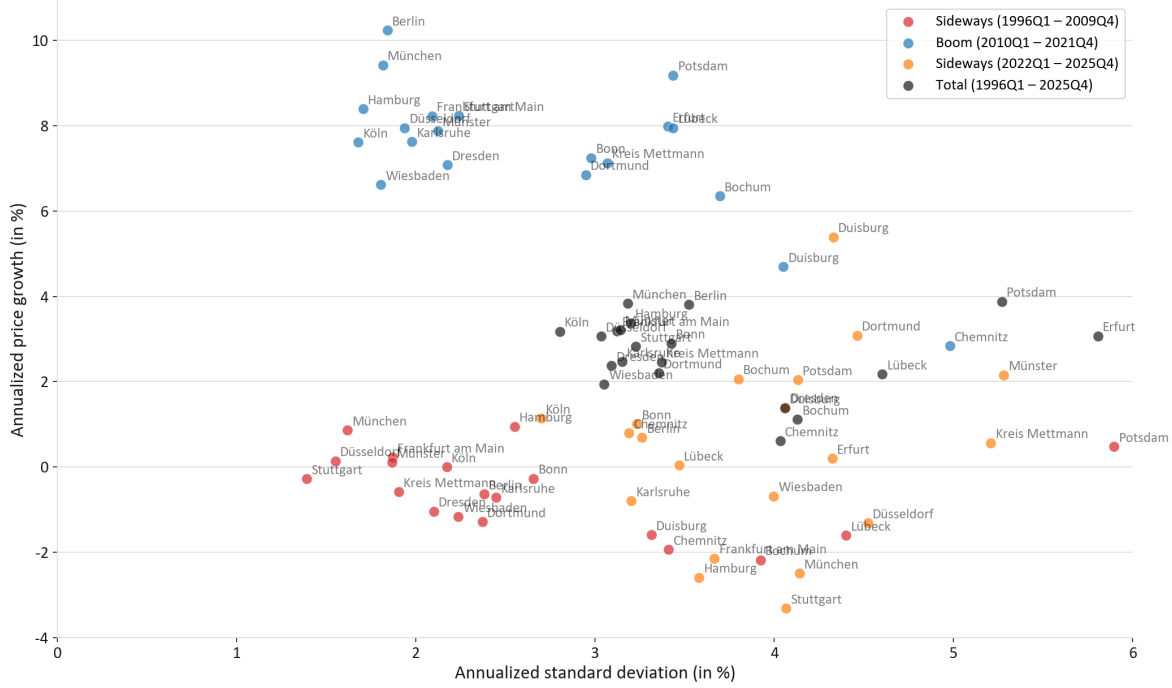
even at low volatility. The phase since 2022 lies in between: efficient portfolios still show positive value growth even though many individual markets already exhibit negative price growth. Especially in downturn and sideways phases, diversification therefore becomes an instrument for limiting losses and accessing positive niches. However, the last phase covers only four years, so the efficient frontier is estimated with substantially fewer data points and is correspondingly more uncertain than those of the longer phases.

The phase dependence becomes even clearer in the portfolio weights. Figure 6 shows the composition of efficient portfolios separately by market phase. During the 2010–2021 boom, efficient portfolios are driven primarily by Münster, Munich, and Berlin. In the 1995–2009 phase, by contrast, more balanced mixes appear, with high weights in Munich, the Mettmann district, Bonn, and Düsseldorf. In the most recent phase since 2022, weights concentrate on a few markets: at the low-risk end, Bonn, Chemnitz, and Cologne are prominent, while Duisburg dominates at the high-return end. Even a simple comparison across the three phases shows how strongly the composition of efficient portfolios shifts over time.

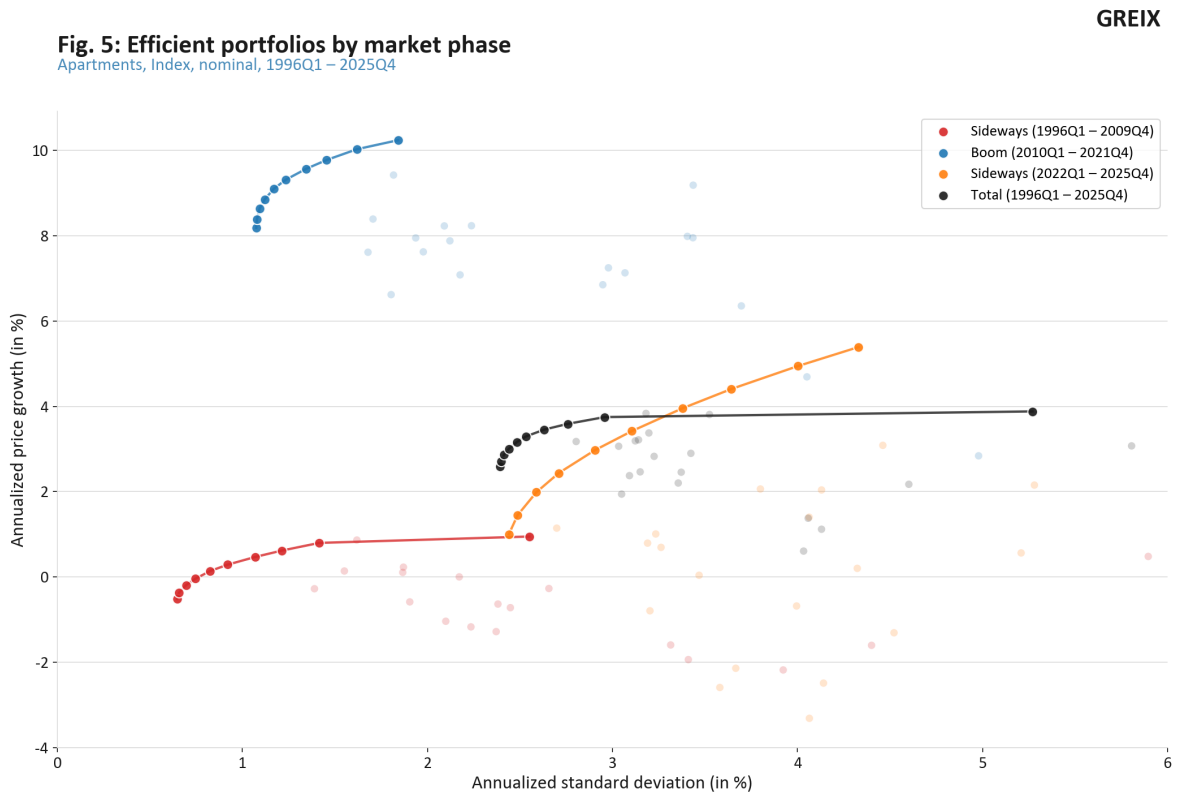
The practical implication is clear: spatial diversification remains useful in all phases, but the efficient combinations are themselves time-dependent. Investors who base decisions only on one phase of the market cycle risk misallocations once market conditions change. Spatial diversification and sensitivity to the respective market phase are therefore closely linked.

Fig. 4: Price growth vs. risk by market phase

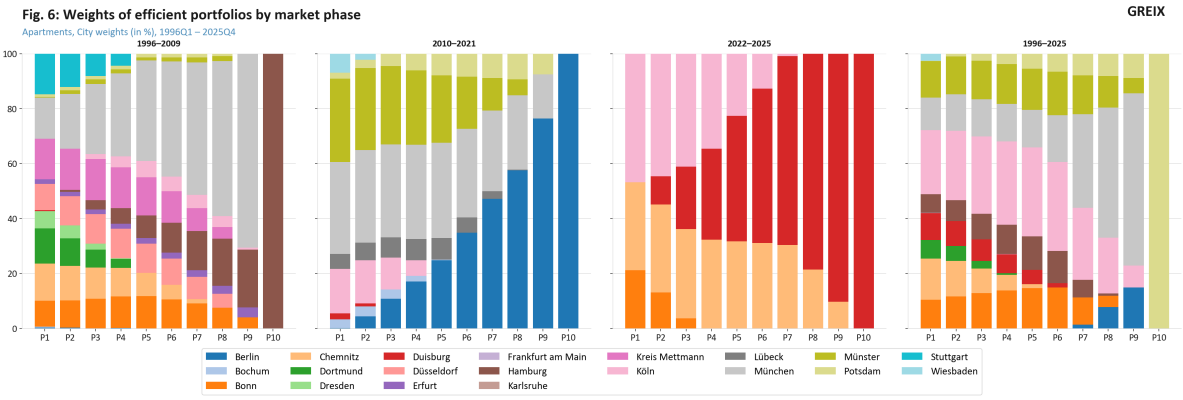
Apartments, Index, nominal, 1996Q1 – 2025Q4



Notes: The figure shows annualized price growth and risk for individual cities in the three market phases and over the full period. Sources: GREIX, own calculations.



Notes: The lines show the efficient long-only portfolios for the three market phases and for the full period; the pale points mark feasible portfolios within the respective phase. Return is defined as annualized nominal price growth, and risk as annualized standard deviation. The analysis is limited to capital gains and assumes no short sales and no transaction costs. Sources: GREIX, own calculations.



Notes: The bars show the weights of efficient portfolios for each market phase and for the full period. The x-axis shows the annualized yearly growth rates and standard deviations, respectively, with standard deviations shown in parentheses. The portfolios are constructed as long-only portfolios and are based exclusively on capital gains. Sources: GREIX, own calculations.

5 Conclusion

The analysis shows that residential real estate investments in German cities cannot be reduced to a simple ranking of good and bad locations. Since 1995, market phases, return profiles, and risk structures have changed markedly. Investors who want to

manage real estate investments on a sound basis therefore need to consider both spatial diversification and the relevant market phase.

Over the full period, a market-weighted portfolio provides a meaningful starting point. It is already well positioned in risk-return space. The efficient frontier shows, however, that improvements beyond this benchmark were possible: even at comparable risk, higher price growth would have been attainable historically, and over long horizons this would have accumulated noticeably. The relevant message is therefore not only that a mixed portfolio can outperform an individual city, but that even relative to a broadly diversified benchmark there was still scope for optimization.

This message is subject to two important qualifications. First, the efficient frontier is an ex post construction: neither future returns nor the co-movement of price changes across cities is known in advance, so the improvement that could actually have been realized is likely to be smaller. Second, efficient combinations shift markedly between the sideways phase, the boom, and the correction. A broadly diversified city portfolio can cushion local risks, but it does not replace an understanding of the current market environment or the careful selection of specific properties and locations.

Spatial diversification pays off – but not as a fixed recipe. Optimal portfolio combinations shift with the market phase, and investors who ignore this risk may end up extrapolating past winning cities into the future. Over the long run, it therefore makes sense to account for both spatial diversification and sensitivity to the current market environment.

Literatur

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GREIX

About

→ ***What is the German Real Estate Index (GREIX)?***

- The German Real Estate Index (GREIX) is a publicly funded research project hosted at the Kiel Institute for the World Economy that aims to increase transparency in the German real estate market. To this end, GREIX regularly publishes updates on the development of sales prices (GREIX sales price index) as well as on the development of asking rents (GREIX rental price index). In addition to these price developments, GREIX publishes special analyses, for example on affordability or on price-determining factors such as location or energy efficiency.

→ ***What is the GREIX sales price index?***

- The GREIX sales price index is a real estate price index for Germany based on the sales price collections of the local expert committees, which contain notarized sales prices. It tracks the price development of individual cities and neighborhoods back to 1960 and is based on more than two million transaction data. The dataset can be used to analyze long-term trends in the real estate markets and to place current developments in a historical context. On greix.de, sales price indices for various market segments in currently 24 cities are freely available. The dataset will gradually be expanded to include additional cities.

→ ***What data and methods are used to create the indices?***

- Data collection is carried out by the local expert committees, which record all property transactions in full. Sales price analysis is conducted using state-of-the-art scientific methods and statistical techniques (hedonic regression method). The GREIX sales price index therefore represents the highest standard of scientific data quality.

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Impressum

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