HOUSING PRICE INDEX TRENDS IN EUROPE (2005–2024):

LINEAR REGRESSION ANALYSIS AND REGIONAL INEQUALITY

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06-25-2025

OUTLINE

Executive Summary

This project analyzes housing price trends across 10 European countries from 2005 to 2024, using linear regression models and time series visualizations. The results reveal strong regional disparities and a negative correlation between initial price levels and cumulative growth

Countries with lower housing prices in 2005 generally experienced faster growth, suggesting a convergence pattern. The combination of statistical modeling and trajectory analysis provides a compelling foundation for understanding housing market dynamics in Europe.

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INTRODUCTION

Between 2005 and 2024

housing prices in Europe experienced dramatic shifts

shaped by

economic cycles, policy changes, and regional disparities

This project

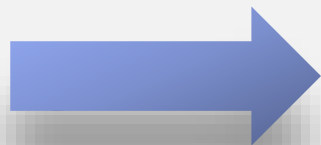explores how these changes unfolded across 10 European countries through data-driven analysis

By combining

descriptive statistics, linear regression modeling, and trajectory visualizations

we uncover

patterns of growth and inequality in the housing market — and what the starting point in 2005 might reveal about each country's path forward.
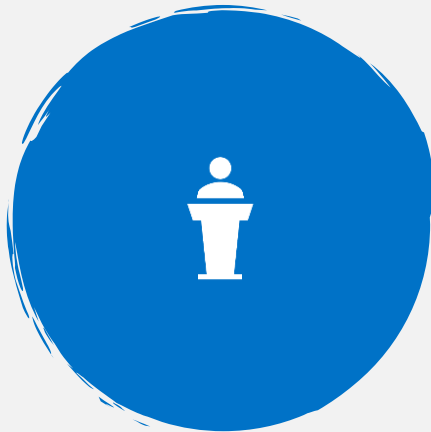
METHODOLOGY

Data Collection

Housing Price Index

(base 2015 = 100)

from Eurostat
(2005–2024)

Preprocessing

Filtering 10 selected countries

Normalizing values and calculating cumulative growth

Creating additional features
(Index_2005)

Linear Regression Models:
Per-country trend analysis (Price Index vs. Year)

Cross-sectional model: Initial Index (2005) → Cumulative Growth
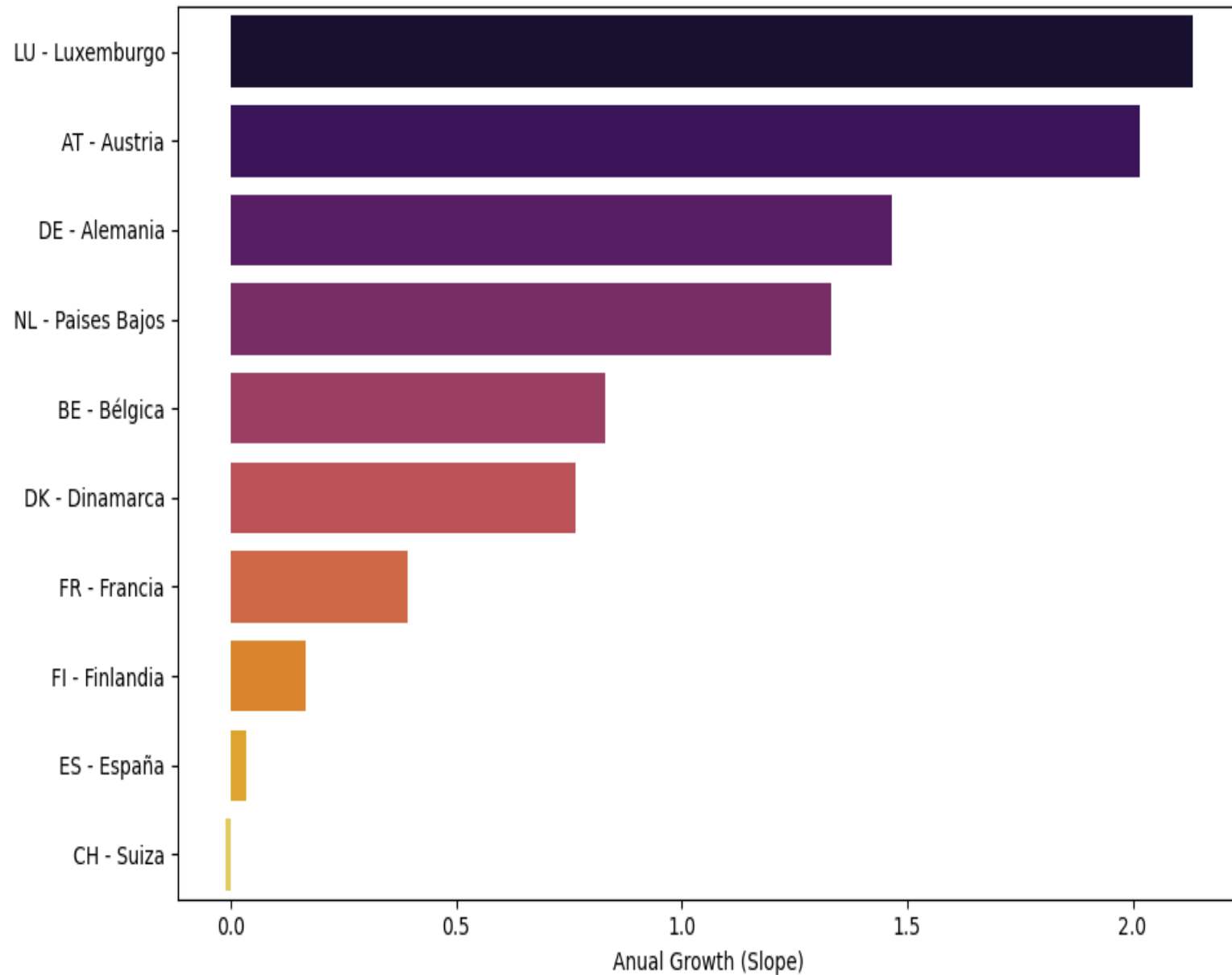
Visualization Techniques:

Bar charts for slope comparisonScatter plots with regression linesFaceted trajectory plots by country

Interpretation & Validation:

Analyze R^2 and slope patternsCross-check model predictions with real country-level behavior.

Slope of Housing Price Index (2005-2024)

DATASET TRENDS: FINDINGS & IMPLICATIONS

Key Findings

Luxembourg, Austria, and Germany showed the steepest growth trajectories based on their regression slopes.

Switzerland, Spain, and Finland exhibited flatter slopes, indicating slower annual housing price growth.

Regression results reveal a negative correlation between initial 2005 price levels and cumulative growth through 2024 (Slope = -0.81, R^2 = 0.835).

This trend suggests a convergence effect: countries with lower housing prices in 2005 grew faster, reducing long-term disparities..

Implications

The starting point in 2005 is a strong predictor of long-term price behavior.

Policymakers could use this insight to identify where housing markets may face overheating risks or lagging investment.

The linear model provides a baseline, but trajectory visualization reveals hidden volatility—useful for more nuanced planning.
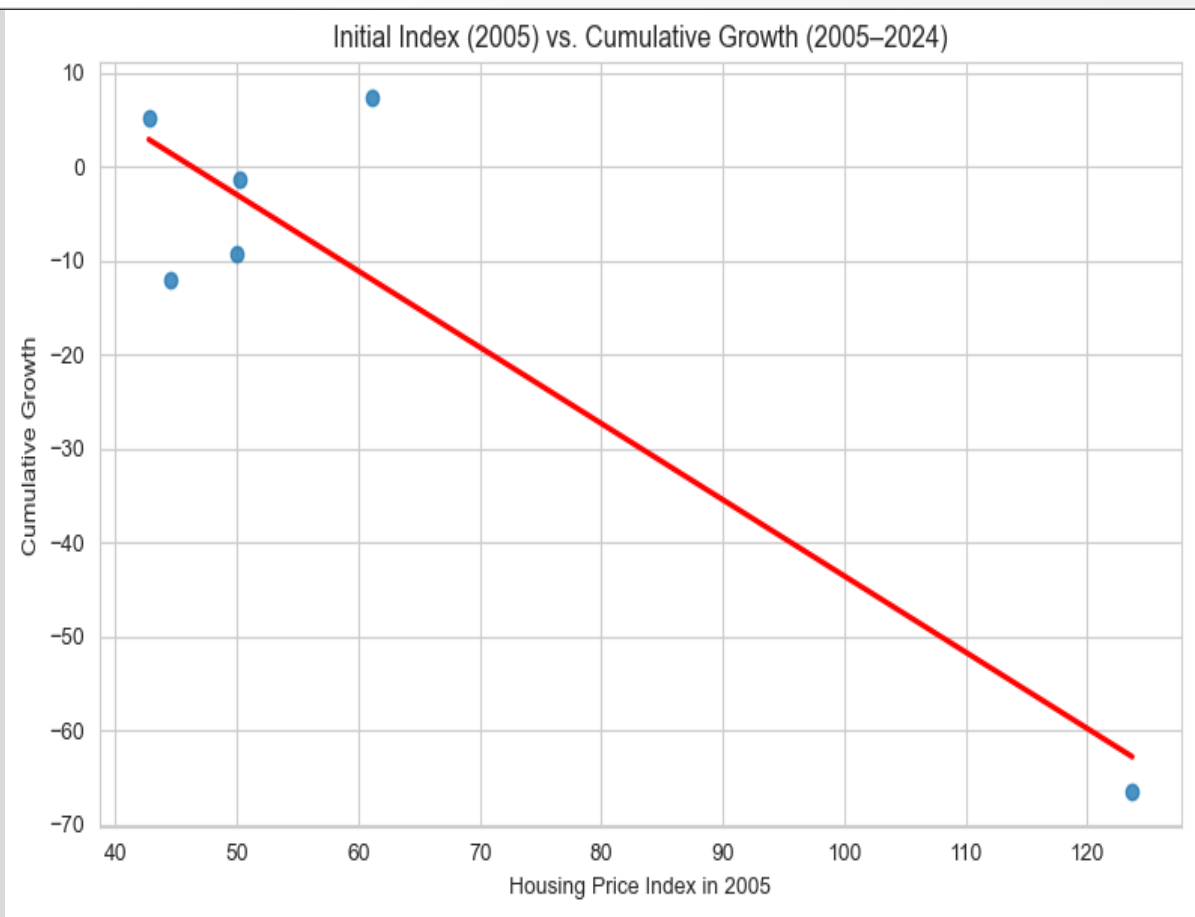
Initial Index (2005) vs. Cumulative Growth (2005–2024)

DATASET TRENDS: FINDINGS & IMPLICATIONS

Findings

Countries with lower housing price index in 2005 experienced greater cumulative growth by 2024.

The linear regression shows a strong negative slope, indicating an inverse relationship between the initial value and growth over time.

The trend line fits well to the data points, validating the strength of the pattern (Slope = -0.81, R^2 = 0.835).

This suggests a convergence effect among European housing markets: those that started low caught up faster.
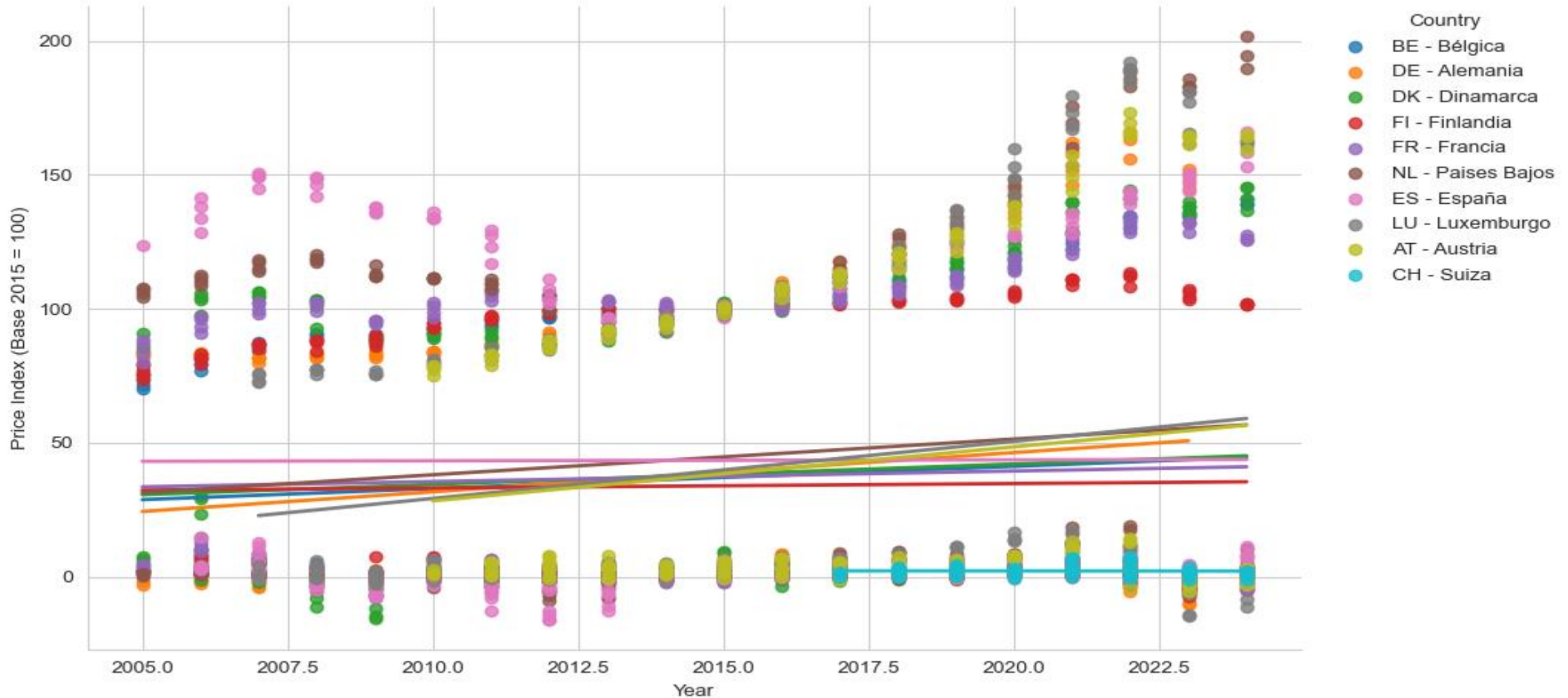
Implications

Initial price levels may serve as a predictive indicator for long-term housing dynamics.

Public policy could leverage this relationship to reduce structural inequalities or monitor for overheating.

The model highlights that equal starting points do not exist, but that markets may self-correct over timewith varying intensities.

# HOUSING PRICE INDEX TRENDS BY COUNTRY (2005–2024)

Housing Price Index Trends by Country (2005–2024)

DATASET TRENDS: FINDINGS & IMPLICATIONS

Findings

- Luxembourg exhibits the steepest and most aggressive price increase, accelerating sharply after 2015, suggesting strong market pressures or demand dynamics.
- Austria and the Netherlands follow stable, nearly linear growth paths, reinforcing a structured and sustained market expansion.
- Germany and France show predictable, steady climbs — the kind of trend that mirrors textbook economic equilibrium.
- Spain stands out with a stagnated trajectory during the late 2000s, pointing to post-crisis inertia followed by late recovery.
- Finland and Belgium reveal flat or slightly rising trends, possibly reflecting affordability ceilings or policy stabilization.
- While the regression slope ranked growth numerically, these trajectories uncover tempo, disruptions, and inflection points invisible to the model.
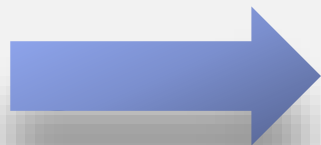
DATASET TRENDS: FINDINGS & IMPLICATIONS

Implications

Visual analysis confirms that linear growth isn't universal — some markets evolve in bursts, others in plateaus.

Policymakers and analysts must examine both the magnitude and the shape of market behavior to plan effectively.

The interplay between initial price, trajectory rhythm, and macro shocks shapes the reality behind each country's housing story.

For meaningful insight, data modeling must be paired with visual storytelling — one explains the slope, the other reveals the heartbeat.
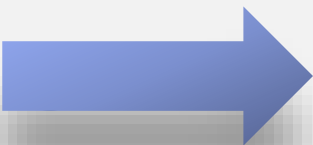
DISCUSSION & CRITICAL OBSERVATIONS

The regression results reveal a clear statistical pattern — but not all growth is linear nor equal.

Some countries, like Luxembourg, far exceeded the model's trendline, suggesting unique drivers (e.g., external investment, tax policy).

Others, such as Spain or Finland, diverged from expectations, possibly due to post-crisis lag or institutional dynamics.

The simplicity of the model allows clarity, but it also omits context: labor markets, population shifts, and policy decisions matter.Visualization adds depth: trajectory shapes, inflection points, and volatility offer insight beyond what slope values suggest.

OVERALL FINDINGS & IMPLICATIONS

A consistent inverse relationship exists between initial housing price levels (2005) and cumulative growth to 2024.

Linear growth patterns emerge in countries with structured markets (e.g., Germany, France), while non-linear deviations are visible in others (e.g., Spain, Luxembourg).

The regression model (R² = 0.835) is statistically strong, but does not capture local disruptions, accelerations, or slowdowns.

Visual analysis enhances interpretation, revealing hidden volatility, post-crisis rebounds, and inflection points overlooked by pure modeling..

Regression is a powerful summary, but must be paired with qualitative and contextual insight to shape policy or investment decisions.

Countries with steeper trajectories may face price overheating risks, while flatter profiles may signal structural stagnation or policy effectiveness.

Policymakers, analysts, and investors should integrate statistical modeling with temporal visualizations to better anticipate housing market evolution.

The regression model highlights a strong inverse relationship between initial housing prices (2005) and cumulative growth through 2024, supporting a convergence dynamic in European markets.

Slope alone is insufficient: country-specific trajectories reveal pauses, accelerations, and market shocks that a linear model can't fully capture.

Combining visual storytelling with regression analysis produces a more comprehensive view of housing price evolution.

The diversity of national trends implies that growth is not purely economic — it is shaped by policy, institutions, and broader societal forces.

CONCLUSION

APENDIX

Data SourceDataset:

Housing Price Index (Base 2015 = 100)

Source: Eurostat – https://ec.europa.eu/eurostat

Timeframe: 2005–2024

Countries analyzed: Austria, Belgium, Finland, France, Germany, Luxembourg, Netherlands, Spain, Sweden, Switzerland

Data Processing Steps

Filtering and selection of 10 EU+ countries with full time

Normalization based on 2015 baseline (Index = 100)

Calculation of cumulative growth: Growth = Index_2024 - Index_2005

Creation of derived variable: Index_2005

Slope calculation via simple linear regression (Index vs. Year) for each country

Limitations

The model does not account for nonlinear trends, policy shocks, or macroeconomic variables such as interest rates or GDP

Cumulative growth masks volatility: sharp dips or rebounds are smoothed over

External influences (e.g. migration, taxation, labor market shifts) were not included
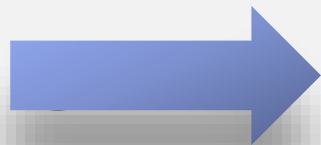
Python Libraries Used

pandas – data transformation

seaborn, matplotlib – plotting and visualization

scikit-learn – linear regression modeling

numpy – numerical operations

THANK YOU!

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