Dutch Property Values: A Municipal Analysis

Analyzing WOZ Trends Across the Netherlands (2016 - 2024)

Reproducible Research Demo

2026-01-29

> ⚠ Not a real research!
>
> Don't mind the narrative but the data is real.

1 Introduction

The Dutch housing market has experienced remarkable changes over the past decade. Property values, as measured by the WOZ (*Waardering Onroerende Zaken*) valuations, serve as a key indicator of real estate market dynamics (Vries et al. 2009). These official government valuations are used for property taxation and reflect market conditions across municipalities.

This analysis examines the evolution of property values across Dutch municipalities using data from Statistics Netherlands (CBS). We address the research question:

> **How have property values evolved across Dutch municipalities since 2016, and what spatial patterns emerge?**

Our analysis uses R for data processing, statistical modeling, and visualization, demonstrating Quarto's capabilities for reproducible research.

2 Data

We use the CBS *Kerncijfers Wijken en Buurten* (Key Figures for Neighborhoods and Districts) dataset (Statistics Netherlands (CBS) 2024), which provides annual statistics at the municipality (gemeente) level.

The dataset contains 3,236 observations covering 408 municipalities from 2016 to 2024.

Table 1: Data summary by year

year	Municipalities	Mean WOZ (€1000)	Median WOZ	Min WOZ	Max WOZ
2016	390	222.15	219.50	122	554
2017	380	226.96	224.00	121	588
2018	375	237.19	233.00	126	637
2019	355	258.33	250.00	131	681
2020	355	277.07	266.00	138	735
2021	352	296.08	284.50	148	775
2022	345	324.37	314.00	167	829
2023	342	374.01	363.00	195	925
2024	342	387.80	380.00	199	900

Beyond WOZ values, the dataset includes housing stock composition (see Figure 4 in the Section 8).

3 WOZ Trends

3.1 Growth Rate Methodology

We calculate the percentage growth in WOZ values for each municipality using the formula:

$$g_i = \frac{\text{WOZ}_{i,t_1} - \text{WOZ}_{i,t_0}}{\text{WOZ}_{i,t_0}} \times 100 \tag{1}$$

where g_i represents the total percentage growth for municipality i over the 2016–2024 period.

3.2 Major Cities

Figure 1 shows the evolution of property values in the 4 largest Dutch cities (G4): Amsterdam, Rotterdam, Den Haag, and Utrecht .

Amsterdam shows the highest property values throughout the period, with WOZ values reaching €498k in 2024. The gap between Amsterdam and other cities has remained substantial.

The growth rates for the G4 cities between 2016 and 2024 are:

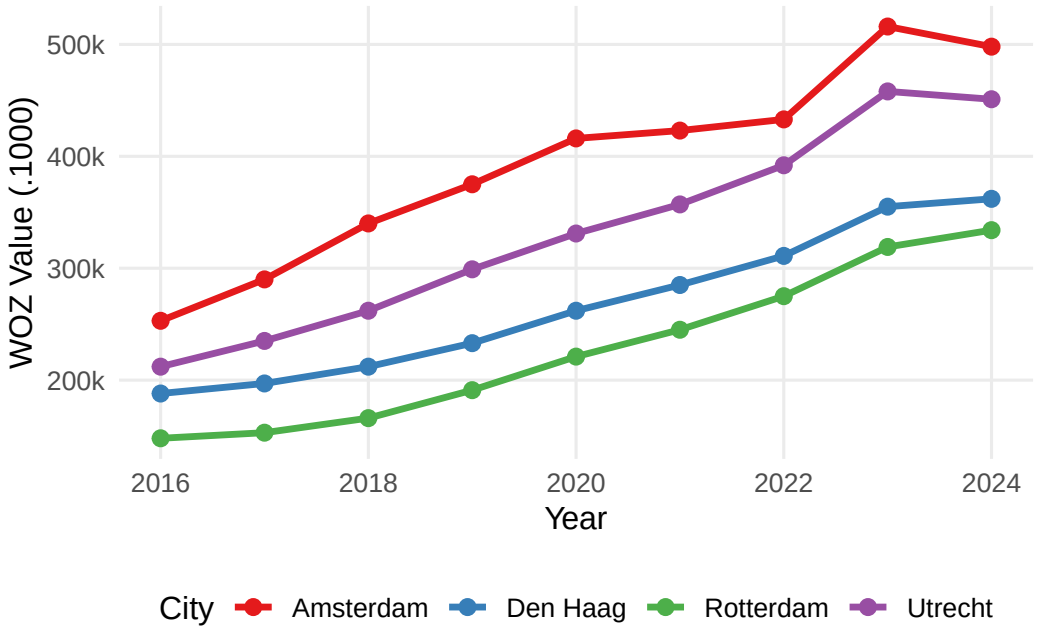

Figure 1: WOZ Value Trends in Major Dutch Cities (2016-2024)

Table 2: WOZ Growth in Major Cities (2016-2024)

City	WOZ 2016	WOZ 2024	Growth (%)
Rotterdam	148	334	125.7
Utrecht	212	451	112.7
Amsterdam	253	498	96.8
Den Haag	188	362	92.6

4 Regression Analysis

To estimate the average annual growth rate across municipalities while controlling for municipal fixed effects, we estimate a panel regression model. Similar approaches using hedonic pricing models have been applied to Dutch real estate appraisals (Guliker, Folmer, and Sinderen 2022). We estimate:

$$\log(\text{WOZ}_{it}) = \alpha + \beta \cdot t + \gamma_i + \varepsilon_{it} \tag{2}$$

where:

Table 3: Panel Regression Results

Dependent Variable:	log_woz
Model:	(1)
Variables	
Year (from 2016)	0.0733***
	(0.0006)
Fixed-effects	
region	Yes
Fit statistics	
Observations	3,233
R^2	0.97703
Within R^2	0.93980

Clustered (region) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

- WOZ_{it} is the WOZ value for municipality i in year t
- β captures the average annual growth rate (in log points)
- γ_i are municipality fixed effects
- ε_{it} is the error term

The regression results indicate an average annual growth rate of **7.6%** in WOZ values across Dutch municipalities (see Equation 2). This estimate is based on 3,233 observations across 408 municipalities.

5 Spatial Distribution

Figure 2 shows the geographic distribution of WOZ values across Dutch municipalities in 2024.

The map Figure 2 reveals clear spatial patterns: the Randstad region (Amsterdam, Utrecht, The Hague) and areas around Haarlem show the highest property values, while peripheral regions in the north and east have lower valuations (Claassens, Koomen, and Rouwendal 2020).

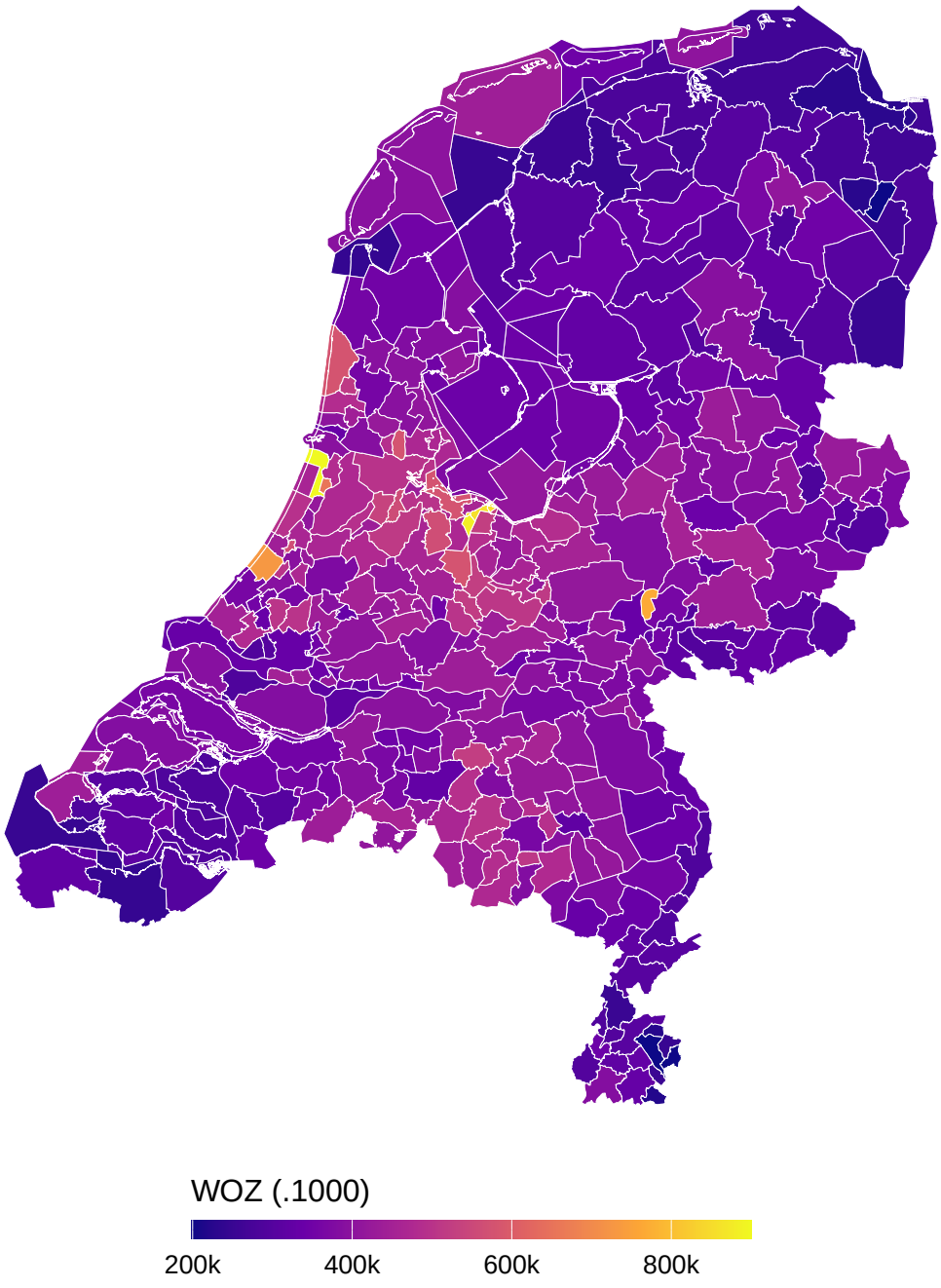

Figure 2: WOZ Values by Municipality (2024)

6 Compound Annual Growth Rate (CAGR) Analysis

Beyond simple growth rates, we can calculate the Compound Annual Growth Rate [CAGR; Cipra (2010)], which provides a smoothed annual rate of return:

$$\text{CAGR} = \left(\frac{\text{WOZ}_{t_1}}{\text{WOZ}_{t_0}} \right)^{1/n} - 1$$

where $n = 8$ years.

> **Note**
>
> The following figure is embedded from a separate analysis document using Quarto's `embed` shortcode, demonstrating modular workflows:

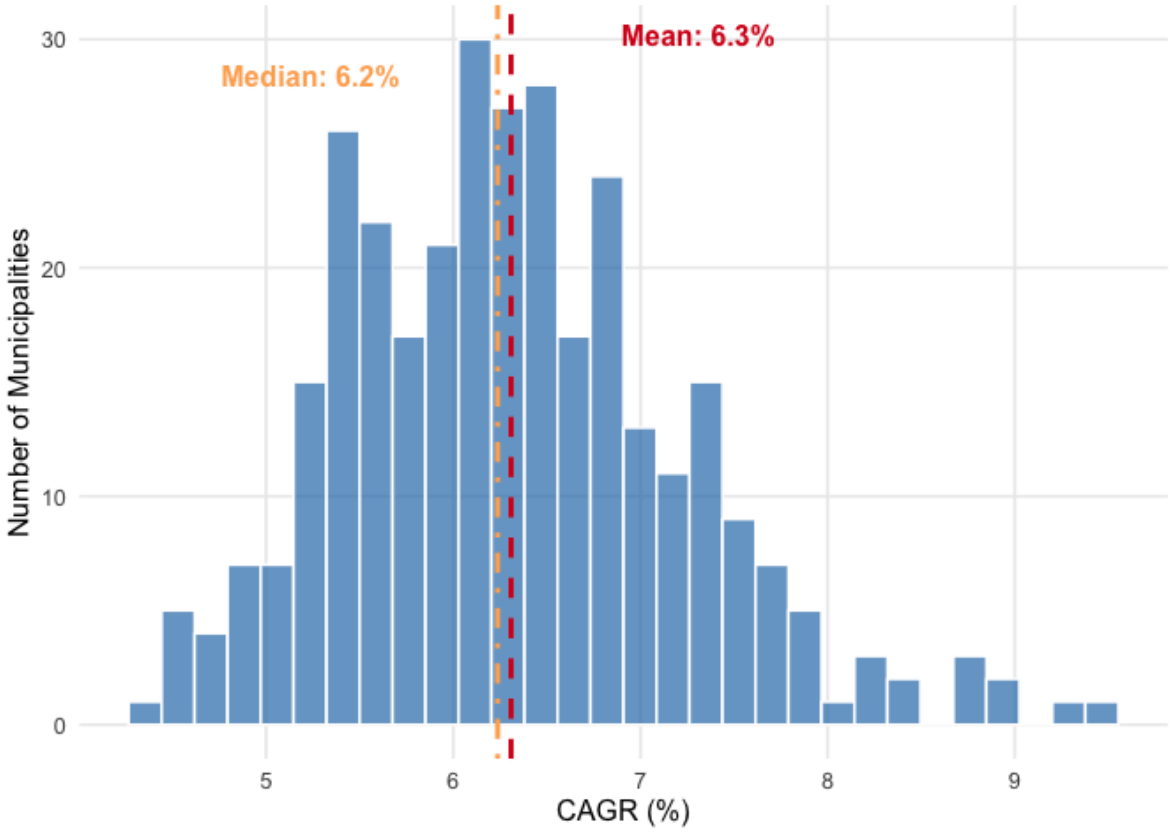

Figure 3: Distribution of Compound Annual Growth Rates

7 Conclusion

This analysis of Dutch property values reveals several key findings:

1. **Substantial growth**: WOZ values increased by an average of 7.6% annually between 2016 and 2024
2. **Urban premium**: Major cities, particularly Amsterdam, maintain significantly higher property values (Musterd, Hochstenbach, and Boterman 2020)
3. **Spatial patterns**: Clear geographic clustering with highest values in the Randstad region

These insights have implications for policymakers, urban planners, and real estate stakeholders in understanding market dynamics and guiding future development.

References

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8 Appendix

8.1 Housing Stock Trends

Figure 4 shows trends in housing stock composition for the G4 cities.

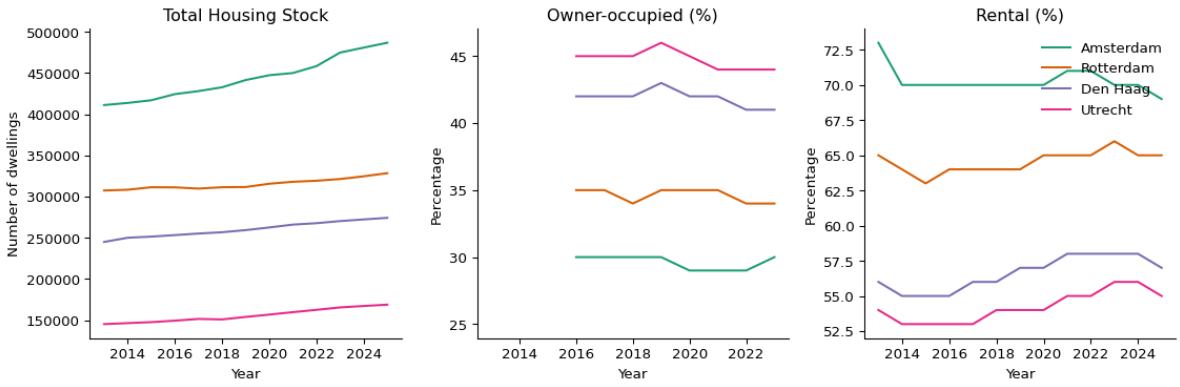

Figure 4: Housing Stock Trends in Major Dutch Cities

> **Note**
>
> Figure 4 is produced using Python and embedded via Quarto's `embed` shortcode—demonstrating multi-language workflows.