# Bay Area Housing Market Data Modeling Portfolio

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# Bay Area Housing Market Data Modeling | Overview

**Timeline: June 2025 – July 2025**

**Context:**
- Housing affordability crisis in the Bay Area; need to quantify relationship between housing CPI (*FRED, BLS*) and average home values (*Zillow*).

**Objectives:**
- Test whether CPI housing index movements explain changes in home values.
- Estimate elasticity to see if housing prices react more than proportionally to cost-of-living pressures.

**Methods:**
- Data Sources: FRED (CPI Housing Index, 2017–2025), Zillow (Avg. Home Values, 2017–2025).
- Analytical techniques (Data cleaning, Excel-based modeling, log-log regression, visualization.)
  - Built Excel-based datasets, cleaned and merged cross-source observations.
  - Conducted regression and elasticity analysis to estimate the responsiveness of home values to CPI fluctuations.
  - Applied supply & demand theory, affordability models, and market benchmarking to interpret results.

# Bay Area Housing Market Data Modeling | Key Analysis



Average Home Values in San Francisco–Oakland–Hayward (2017–2025)
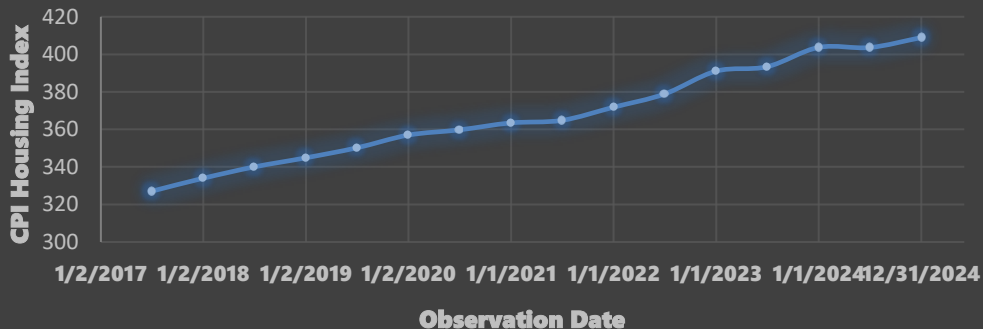($ in Thousands)
Data Source: Zillow Homes Value Index



CPI Housing Index: San Francisco–Oakland–Hayward (2017–2025)
Data Source: FRED – U.S. Bureau of Labor Statistics (BLS)
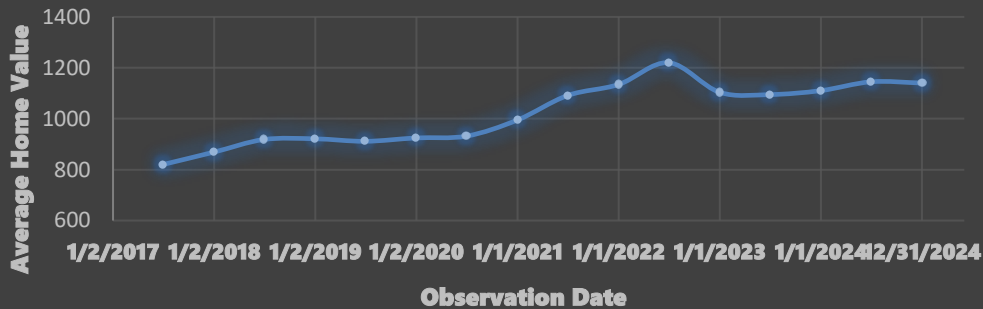
- CPI Housing Index (*FRED*): 327 → 409 (+25%)

- Average Home Value (*Zillow*): $820k → $1.14M (+39%)

- Observation: Home values rose faster than CPI, suggesting elasticity > 1.

# Regression Analysis (Elasticity Estimation)

**Model:**

$$\ln(\text{Home Value}) = \alpha + \beta \cdot \ln(\text{CPI}) + \epsilon$$

**Outputs:**

- Estimated coefficient: *$\beta$ = 5.5662*
- *Constant: -45.719*
- *$R^2$ = 0.8242 → model explains ~82% of variation* in log(Home Value).

**Interpretation (Elasticity):**

- A 1% increase in the CPI Housing Index is associated with a 5.6% increase in average home values.
- Strong positive elasticity suggests that housing demand is highly sensitive to CPI-driven costs (supply constraints magnify cost pass-through effects).



ln(Home Value) on ln(CPI)

y = 5.5662x - 45.719
$R^2$ = 0.8242

ln(Average Home Value)

ln(CPI Housing Index)
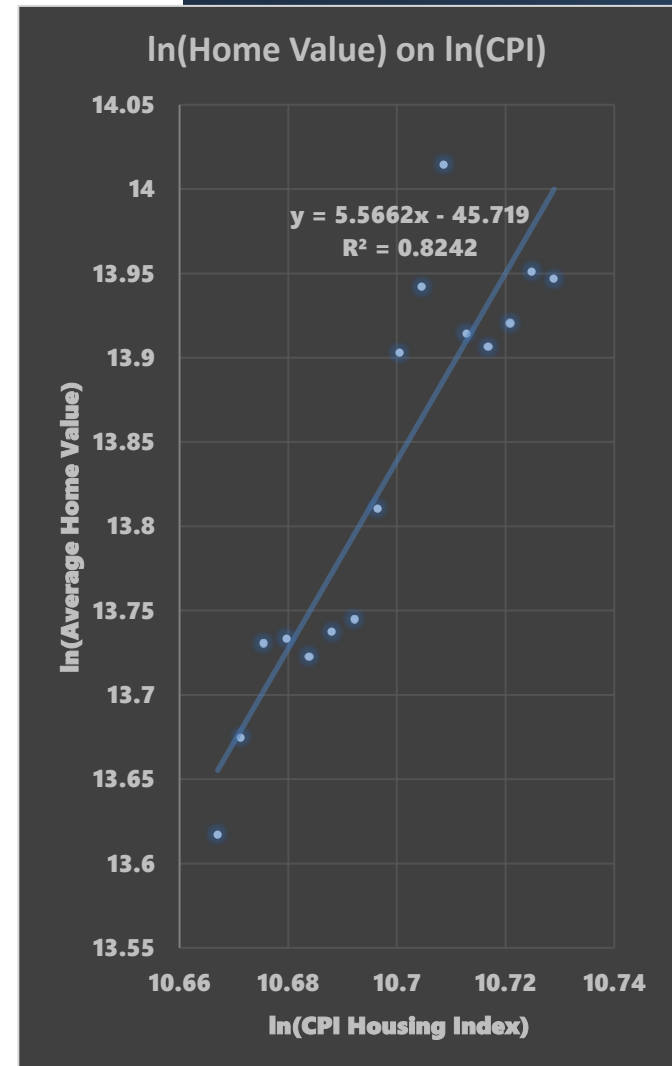
# Economic Theory Insights | Strategic Implications

**Supply-Side Constraints (Internal Market Dynamics)**

- *Inelastic Housing Supply*: Land scarcity, zoning restrictions, and high construction costs limit new housing stock.
- *Elasticity Implication*: CPI cost shocks (materials, rent components) disproportionately raise home values, as supply cannot absorb demand.
- *Consulting Lens*: Comparable to a firm with *capacity bottlenecks* as costs pass through directly to consumer prices.

**Demand-Side Pressures (Consumer Behavior)**

- *Income vs. CPI Gap*: Household income growth trails CPI increases, worsening affordability ratios.
- *Consumer Segmentation*: Higher-income households absorb cost increases, but middle/lower-income households are priced out.
- *Consulting Lens*: Shifts in *customer segments* resemble a firm losing mid-market buyers while retaining only premium consumers.

**Competitive Benchmarking (External Market Dynamics)**

- *San Francisco vs. Peer Metros*: Compared to LA, Seattle, or Austin, SF housing values show higher CPI elasticity due to tighter supply.
- *Market Entry Barriers*: High cost of entry (land, permits) prevents "competitor" housing supply from entering.
- *Consulting Lens*: Analogous to a *monopoly/oligopoly market*, where incumbent barriers protect high margins but reduce inclusivity.

**Profitability & Investment Implications**

- *Developers' Profitability*: Rising CPI raises both input costs and potential selling prices; margins depend on ability to pass costs through.
- *Policy/Regulation Risk*: Rent control or affordability mandates could compress margins as a "regulatory competitor" in the market.
- *Consulting Lens*: Mirrors a firm in a *high-margin but high-regulation industry* (like utilities or pharmaceuticals).

**Strategic Takeaways**

- CPI shocks act as a profit driver for developers, but a cost burden for consumers.
- Housing affordability crisis reflects a misalignment of supply chain constraints with consumer demand elasticity.
- Any solution requires dual levers:
  - *Internal* (supply-side reform): Incentivize new housing stock, streamline construction, reduce input costs.
  - *External* (market-facing strategy): Policy reforms, subsidies, or zoning changes to rebalance affordability.

# Bay Area Housing Market Data Modeling | Key Takeaways

**1. Elasticity Signals Market Fragility**

- Regression coefficient (~5.6) highlights how *small CPI shocks produce outsized price effects*, confirming systemic volatility.
- High $R^2$ (0.82) indicates *structural consistency* across time, reinforcing reliability of the model.

**2. Risk Landscape**

- *Macro Risks*: Inflationary shocks and interest rate hikes amplify affordability stress.
- *Micro Risks*: Local dependence on tech-sector wages → income volatility tied to cyclical employment.
- *Regulatory Risks*: Future policy interventions could abruptly shift profitability dynamics.

**3. Strategic Opportunities**

- *For Policymakers*: Targeted interventions (zoning flexibility, modular housing adoption) can smooth CPI sensitivity.
- *For Developers*: Long-term opportunity in *mid-tier housing* where unmet demand is structurally locked out.
- *For Investors/Consultants*: Case parallels *capacity-constrained industries* like airlines or energy opportunities exist, but only with careful risk hedging.

**4. *Broader Economic Insight***

- The Bay Area housing market functions as a *two-sided constraint problem*: CPI-driven input costs push from above while stagnant income growth pushes from below.
- Result: A *barbell effect* where premium consumers dominate and affordability gaps widen.

# Data Sources & References

**U.S. Bureau of Labor Statistics (BLS), Federal Reserve Economic Data (FRED)**

*Consumer Price Index for Housing: San Francisco-Oakland-Hayward (2017-2025)*

**Source: *https://fred.stlouisfed.org***

**Zillow Research**

*Zillow Home Value Index, San Francisco-Oakland-Hayward Metro Area (2017-2025)*

**Source: *https://www.Zillow.com/research/data***