

# Do macroeconomic factors matter in housing markets?

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## Abstract

This research examines whether most variation in house price changes is mainly driven by local or national factors. Employing a novel data containing both capital appreciation and income component in the U.S. Metropolitan Statistical Areas, results show that macroeconomic factors, absorbed by time fixed effects, account for 43% of the variation in capital gains and 2% of the variation in rental yields. Overall, the findings empirically support the prior literature assuming that the nature of housing markets is mainly local. The findings suggest a greater role of local factors for understanding cross-sectional income returns in housing markets.

*Keywords:* Housing markets; National factors; Local factors

## 1. Introduction

Housing comprises the largest component of total household wealth in most countries (e.g., Brounen et al., 2014; Poterba, 2000; Xie & Jin, 2015). Changes of housing wealth significantly affect the households' consumption decisions (e.g., Chen et al., 2020; Guo & Hardin, 2014, 2017). Therefore, governments aim to shape the housing market through fiscal and monetary policy. This motivates economists to understand whether much of the variation in house price changes is mainly driven by local or national factors. In doing so, new light can be shed on the implications of government intervention, balanced national development and portfolio diversification strategy.

While standard asset pricing theories in finance suggest that asset prices are mainly determined by market-wide factors (which are common to assets everywhere), conventional urban models suggest that local factors play a dominant role (which affect all houses within one region, but nowhere else). Coskun et al. (2020) conclude a joint role of both market-wide and region-specific factors in driving house price movements. Unlike financial assets, housing serves as a dual role of investment and consumption good; therefore, homeowners would face both financial risk at the national level and consumption hedge effect at the local level (Han, 2013).

A strand of literature by Hwang and Quigley (2006), Han (2013) and Glaeser et al. (2014) presumes that local rather than national factors drive most variation in house price changes; however, the empirical evidence to support this argument is scant. The few evidence documented thus far is conducted by Glaeser et al. (2014) whose result from the capital appreciation perspective suggests that the variation in house price changes in the U.S.

Metropolitan Statistical Areas (MSAs) is mainly driven by local factors. A need to investigate the nature of housing markets from a (imputed) rental income perspective is evident, since, first, homeownership is mainly a consumption decision with a potential appreciation on housing assets, and second, the main source of return of homeownership is from the income return, not the capital gain return (Jorda et al., 2019).

To bridge the gap in the literature, we use monthly Zillow data from January 2014 to December 2019 to investigate the nature of housing markets in the U.S. MSAs from both capital appreciation and income perspectives. Following Glaeser et al. (2014), time fixed effects are employed in the panel regression modelling to proxy for macroeconomic factors. Results from capital gains and rental yields affirm the conclusion of Glaeser et al. (2014) that the nature of housing market is mainly local. Interestingly, the results show that merely 2% of the variation in rental yields is contributed by the national, month-specific fixed effects, suggesting a more important role of local factors in the context of the rent saving of owner-occupiers.

The assessment of the main findings across MSAs based on affordability, population and census division follows for a robustness check. The results of housing portfolios of different regional characteristics consistently show that macroeconomic factors account for all less than 15% of the variation in rental yields across almost every housing portfolio, affirming an essential role of local factors in the income component of housing returns across regions. Interestingly, we also find that in more affordable areas, the macroeconomic factors account for more variation in both capital gains and rental yields. This may potentially suggest a greater

government intervention in more affordable housing markets. The results remain robust, when MSA fixed effects are incorporated into modelling.

More broadly, this research engages with considerable literature on regional house price convergence.<sup>1</sup> We extend by investigating the relative importance of macroeconomic factors in regional markets. The documented results in this setting can be viewed as an indicator of integration, as common factors are one of key drivers for the convergence. As highlighted in Fairchild et al. (2015), quantitatively separating the effect of national factors from that of local factors in the housing market is essential, since policymakers, for example, are interested in whether monetary policy is responsible for regional housing bubbles by keeping the short-term interest rate low for a long period of time.

Finally, this work is closely related to Glaeser et al. (2014). While they empirically show that the nature of housing markets is largely local based on the evidence of capital appreciation, we complement and reconfirm their findings from both capital appreciation and income perspectives. The results further indicate that the importance of local factors can be particularly masked in the income return of housing markets. Altogether, the research provides empirical support to the long-held assumption in the literature that housing markets are local in nature. The structure of the paper is as follows: Section 2 relates our work to the literature review, Section 3 describes the data, Section 4 presents the empirical analysis, and Section 5 concludes.

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<sup>1</sup> See, for example, Cook (2003, 2005, 2012), Holmes and Grimes (2008), Montagnoli and Nagayasu (2015), Gong et al. (2016), Antonakakis et al. (2018), Gray (2018), Holmes et al. (2011, 2017, 2019), and Miles (2015, 2019).

## 2. Literature Review

The pioneering work by Han (2013) shows that housing markets are mainly driven by two sources of risk: financial risk at the national level and the consumption hedge effect at the local level. This section discusses two strands of literature that explains the variation in house price changes.

### 2.1 Systematic Risk

The canonical Capital Asset Pricing Model (CAPM) of Sharpe (1964), Linter (1965), Mossin (1966) and Black (1972) and the Arbitrage Pricing Theory (APT) of Ross (1976) highlight that asset returns are determined by exposure to systematic risk (i.e., the financial risk inherent in the entire market). Though the empirical tests of standard asset pricing theory have long centred on equity assets, Roll's (1977) critique suggests the application of real estate should be included. Therefore, as is usual for financial assets, the risk premium of housing assets should be their exposure to systematic risk (Bayer et al., 2010). The positive trade-off between systematic risk and return is empirically supported by Cannon et al. (2006), Case et al. (2011), Beracha and Skiba (2013), and Beracha et al. (2018).

Systematic risk is particularly important in the housing market, especially considering the role of monetary policy in housing<sup>2</sup> and its interaction with financial markets. Yang et al. (2018) argue that households make portfolio decisions based on expected housing development and financial-market dynamics. As highlighted in Kim and Cho (2010), the government plays

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<sup>2</sup> Regarding the relationship between monetary policy and housing markets, see, for example, Aoki et al. (2004), Goodhart and Hofmann (2008), Bofinger et al. (2013), Rubio (2014), Ngo (2015), Tsai (2015b), and Rahal (2016).

a role in achieving house price stability. Theoretically, there exists an inverse relationship between house prices and interest rates based on conventional monetary policy. Under the influence of low interest rates, housing in the U.S. started to jump to a 25 year high by the end of 2003 and remained high until a sharp decline began in early 2006 (Taylor, 2007). Evidence of unconventional monetary policy, in the form of innovations of the monetary base, also shows the positive and persistent response of house prices to policy shocks of increasing innovation (Rahal, 2016).

Though housing is traded in the private market, it can also be affected by information in the public market. Dieci et al. (2018) illustrate that housing investors' participation depends on the market price trends in the stock market. Xia et al. (2020) show that long-term information from economic policy uncertainty and stock market influences most of regional housing markets in China.<sup>3</sup> Simultaneously, ripple effects across regions can also lead to housing frenzies on a national scale (Chen & Chiang, 2019; Meen, 1999). As argued in Tsai (2014, 2015a), regional housing markets interact with the national housing market. All of these suggests a crucial interplay between housing and macroeconomy.

## *2.2 Local Risk*

Unlike financial assets, housing serves a dual role of financial asset and consumption-hedge; thus, the pricing factors that affect residential real estate markets can be both national and local (Han, 2013). Though standard asset pricing theory would imply a minor role for idiosyncratic risk in the asset pricing of housing markets (i.e., the local risk within a region),

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<sup>3</sup> Regarding the interaction between housing and equity markets, see, for example, Okunev et al. (2000), Li et al. (2015), Dieci et al. (2018), Gazzani (2020), and Xia et al. (2020).

local factors can be important in housing markets. The standard urban models of Alonso (1964), Rosen (1979) and Roback (1982) propose that house prices reflect a spatial equilibrium, in which prices are determined by local wages and amenities. Specifically, urban models typically formulate the housing decision of where to live as a discrete choice about a bundle of housing and neighbourhood attributes.

The local ‘fundamentals’ driving the change in house prices have long been emphasised in the housing literature. Hwang and Quigley (2006) and Beracha et al. (2018) provide a complete review emphasising and identifying local economic fundamentals in housing markets such as employment, income, population, residential construction activity and so on, confirming the significance of local economic conditions to the U.S. metropolitan regions. To further advance our knowledge of local dynamics, several related indices are proposed and published, such as the land share value in Davis and Palumbo (2008), the land regulation index in Gyourko et al. (2008), land supply elasticity in Saiz (2010), and the quality of life, trade-productivity and total amenity indices in Albouy (2016).

Understanding local factors is important, since households make decisions for homeownership based on local markets within which they reside. Sinai and Souleles (2005) find that homeownership can hedge against rent risk. Guo and Hardin (2017) further document that in the long-term, homeownership serves as buffers to household income or cash flow volatility to ensure a stable consumption pattern. Considerable literature indicates that owning a property allows households to hedge against upward housing cost (e.g., Cocco, 2000; Guo & Hardin, 2017; Han, 2008, 2010, 2013; Ortalo-Magne & Rady, 2002; Sinai & Souleles, 2005; Zhou, 2016). Motivated by the local hedging incentives, Han (2013) shows that in an

intertemporal framework, households would accept lower return in housing to compensate future consumption risk.

### *2.3 Research Motivation*

Fundamentally, house prices are mostly affected by common aggregate factors based on standard asset pricing models. Yet, local supply and demand can drive heterogeneity in house price changes across regions, according to conventional urban models. Though a body of literature such as Hwang and Quigley (2006), Han (2013) and Glaeser et al. (2014) conform to the view that the variation in house price changes is mainly local, the empirical support for this argument is limited.

The first attempt, or one of the first, is conducted by Glaeser et al. (2014). Using the repeat sales indices published by Federal Housing Finance Agency (FHFA), their results on the capital appreciation show that the nature of housing markets across MSAs in the U.S. is mainly local. However, capital gains only comprise 23.27% in total return based on 16 countries' evidence from 1870 to 2015 (Jorda et al., 2019). Therefore, the need for the investigation about the nature of housing markets from income perspective is evident. This research aims to better understand the nature of housing markets from both capital appreciation and income perspectives.

## **3. Data Description**

Unlike FHFA, Zillow provides housing market information for both capital appreciation and rental income. Therefore, following the recent trend in housing literature (e.g.,



Bailey et al., 2018; Giroud & Mueller, 2017, 2019; Kaplan et al., 2020; Mian et al., 2015), we employ the Zillow Home Value Index, tracking the monthly median home value based on the estimated market value for around 100 million houses across the U.S.

The Zillow Home Value Index is further paired with the Zillow Observed Rent Index over the period January 2014 to December 2019, leading to a sample of 103 MSAs. The rent index is estimated based on changes in asking rents over time, adjusting for changes in the quality of the available rental stock. Table 1 presents the related summary statistics of capital gains and rental yields in the top 3 largest MSAs regarding population among the sample of 103 MSAs. Consistent with Jorda et al. (2019), the rental yields are larger than the capital gains across the three MSAs, since income return is a key source of return in housing assets.

**Table 1.** Summary statistics of housing returns in top 3 MSAs

	Mean (%)	SD (%)	Min (%)	Max (%)	Obs
Panel A: Capital Gains					
Chicago	0.23	0.31	-0.30	1.30	71
New York	0.21	0.29	-3.16	1.28	71
Los Angeles	0.32	0.41	-0.75	1.74	71
Panel B: Rental Yields					
Chicago	0.75	0.02	0.71	0.77	71
New York	0.57	0.02	0.54	0.59	71
Los Angeles	0.37	0.01	0.36	0.38	71

Notes: The monthly housing and rent indices are collected from Zillow over 2014:M1 to 2019:M12. The indices are deflated by the net-of-shelter consumer price index published by the Bureau of Labour Statistics (BLS). The capital gain is calculated as:  $R_t = \ln ( P_t/P_{t-1} )$  where  $P_t$  is the price index at time  $t$ . The rental yield is measured by  $\frac{Rent_t}{P_t}$  (rents divided by housing prices at time  $t$ ).

Before proceeding to the main analysis, one should, at this juncture, acknowledge the potential limitation in the present research. It is recognised that rental units can vary from owner-occupied units (Glaeser & Gyourko, 2010). Nevertheless, estimating rents of homeowners may involve errors in the survey (Jorda et al., 2019). Hence, the results shall be

interpreted with limitation, particularly when trends in the implicit rental price of owner-occupied housing are not captured by the explicit rental price of tenant-occupied housing.

#### **4. Empirics: Nature of Housing Markets**

This section empirically examines whether housing markets are mainly local or national in nature.

##### *4.1 Research Methodology*

To quantify the significance of national factors in housing markets, the following panel data regression is estimated:

$$Housing\ Market_{i,t} = \alpha + \beta_t + \varepsilon_{i,t}, \quad (1)$$

where  $Housing\ Market_{i,t}$  is one of two variables to proxy the performance of the housing market: capital gain (measured by the first difference of the natural logarithm of the housing price index) and rental yield (measured by rent to price ratio) for the dependent variable and  $\beta_t$  is a month fixed effect.

To directly investigate the nature of housing markets, we consider the time fixed effects as the major independent variable only, which allows us to compare our result directly against Glaeser et al. (2014). The unobserved effect of common macro factors at the national level, such as changes in interest rates and tax codes, are absorbed by time fixed effects in a panel analysis. Therefore, the housing literature of Han (2013) and Glaeser et al. (2014) views time

fixed effects as a proxy to control for the impact of national factors. This approach enables us to directly decompose the relative importance of national and local factors in housing markets.

Given that only one explanatory variable is used in the modelling, it is worthwhile to check whether the result remains robust, when other factors are controlled. To do so, we re-consider Equation (1) and expand it into two-way fixed effects for  $i$  regional markets and  $t$  time periods:

$$\text{Housing Market}_{i,t} = c + \alpha_i + \beta_t + \varepsilon_{i,t}, \quad (2)$$

where  $\alpha_i$  is a MSA fixed effect and  $\beta_t$  is a time fixed effect. A general way of modelling MSA fixed effects involves using city dummies to allow the intercept to differ across regional markets, whereas the modelling of time fixed effects allows the intercept to vary across different time periods.

In empirical housing modelling, the unobserved effect of common macro factors at the national level can be absorbed by time fixed effects in a panel analysis, while the unobserved effect of time-invariant factors at the city level (such as geographical constraints and local amenities) can be absorbed by MSA fixed effects (Favara & Imbs, 2015; Han, 2013). Finally, after estimating the baseline model, we decompose the variation in housing returns attributable to different factors by applying a parametric framework, analysis of covariance (ANCOVA).

## 4.2 Main Result

Based on the house price index published by FHFA, Glaeser et al. (2014, p.45) find “barely more than one quarter of the variation in price changes across cities can be accounted for by national, year-specific fixed effects.”<sup>4</sup> Using a different dataset from Zillow, the results in Table 2 from both capital gain and income return perspectives affirm Glaeser et al.’s (2014) conclusion that the nature of housing markets is mainly local, given that 43% of the variation in capital gains and 2% of the variation in rental yields are explained by national, month-specific fixed effects. Altogether, based on the evidence of capital appreciation and income perspectives, we empirically support the prior literature assuming that the nature of housing markets is mainly local.

**Table 2.** Impact of time fixed effects on housing markets

	Capital gain	Rental yield
Model fitness	43%	2%

Notes: Table 2 presents the result of R-squared based on Equation (1):  $Housing\ Market_{i,t} = \alpha + \beta_t + \varepsilon_{i,t}$  with the application of monthly data from 2014:M1 to 2019:M12. All the variables are in real terms, deflated by the net-of-shelter consumer price index published by the BLS.

### 4.3.1 Robustness Check: Housing Portfolios

We next investigate whether the main finding can robustly hold across MSAs of different regional characteristics. Following Lin (2022), the housing portfolios are sorted based on its census division, affordability, and population.<sup>5</sup> Comparing the results of different housing portfolios across Panels A, B and C in Table 3, time fixed effects all provide low explanatory power below 15% of the variation in the rental yields except for West North

<sup>4</sup> The findings of Glaeser et al. (2014) refer to the results in real terms. Thus, the nominal house and rent value indices used in this study are deflated by the net-of-shelter consumer price index published by the BLS.

<sup>5</sup> The rank of population statistics of each MSA is provided in Zillow dataset and the median house price is used as the proxy for housing affordability.

Central Division. Overall, the results emphasise a key role of local factors in understanding the variation of income return in housing markets.

**Table 3.** Impact of time fixed effects on housing portfolios

	Capital gain	Rental yield
Panel A: Census division		
Pacific	47%	2%
Mountain	50%	11%
New England	52%	3%
South Atlantic	53%	6%
Middle Atlantic	57%	9%
East North Central	56%	12%
East South Central	61%	7%
West North Central	52%	40%
West South Central	73%	6%
Panel B: Affordability		
Affordable	49%	14%
Expensive	44%	2%
Panel C: Population		
Small	41%	2%
Large	47%	3%

Notes: Table 3 presents the result of R-squared based on Equation (1):  $Housing\ Market_{i,t} = \alpha + \beta_t + \varepsilon_{i,t}$  with the application of monthly data from 2014:M1 to 2019:M12. All the variables are in real terms, deflated by the net-of-shelter consumer price index published by the BLS. The housing portfolios are sorted based on regional features.

Turning to census divisions, it seems that areas with relatively lower housing supply elasticity are less subject to macroeconomic factors, as evidenced in both capital gains and rental yields for Pacific division. Interestingly, results in affordable areas indicate that the variation in both capital gains and rental yields contributed by time fixed effects is significantly higher than expensive areas. This may potentially imply a higher level of government intervention in affordable housing markets.

#### 4.3.2 Robustness Check: Other Factor

For alternative robustness check, we consider a linear unobserved effects model with two-way fixed effects (i.e., MSA and time fixed effects). While the approach of one-way fixed

effects model allows a more direct comparison against Glaeser et al. (2014), other explanatory variables at the micro level could have been incorporated into modelling. However, due to the “monthly” data used in this study, it is infeasible to find local factors of the same frequency. To address this issue, we exploit the feature of panel data and employ MSA fixed effects as an additional control variable to proxy for time-invariant local factors, with results reported in Table 4.

**Table 4.** Impact of two-way fixed effects on housing portfolios

	(1) Model fitness: Capital gain	(2) Variance decomposition: Time fixed effects (MSA fixed effects)	(3) Model fitness: Rental yield	(4) Variance decomposition: Time fixed effects (MSA fixed effects)
Panel A: Census division				
Pacific	48%	89% (11%)	98%	11% (89%)
Mountain	52%	87% (13%)	96%	8% (92%)
New England	57%	94% (6%)	91%	5% (95%)
South Atlantic	65%	87% (13%)	97%	12% (88%)
Middle Atlantic	55%	80% (20%)	78%	3% (97%)
East North Central	59%	89% (11%)	98%	2% (98%)
East South Central	65%	78% (22%)	83%	7% (93%)
West North Central	72%	94% (6%)	95%	41% (59%)
West South Central	65%	75% (25%)	97%	7% (93%)
Panel B: Affordability				
Affordable	62%	78% (22%)	91%	7% (93%)
Expensive	57%	75% (25%)	98%	2% (98%)
Panel C: Population				
Small	56%	70% (30%)	96%	2% (98%)
Large	57%	80% (20%)	98%	3% (97%)

Notes: Table 4 presents the result of adjusted R-squared based on Equation (2):  $Housing\ Market_{i,t} = \alpha + \alpha_i + \beta_t + \varepsilon_{i,t}$  with the application of monthly data from 2014:M1 to 2019:M12. All the variables are in real terms, deflated by the net-of-shelter consumer price index published by the BLS. The housing portfolios are sorted based on regional features. Columns (2) and (4) display the corresponding variance decomposition results for capital gains and rental yields, respectively. We first compute the partial sum of squares for each effect in the model and then normalise each estimate by the sum across the effects, forcing the sum to one.

In comparison with Table 3, Table 4 shows that the model fitness improves for both capital gains and rental yields across almost all housing portfolios, when additional MSA fixed

effects are incorporated. To better understand the attribution to explanatory power, we further decompose the variation in housing dynamics attributable to MSA and time fixed effects by ANCOVA. We compute the partial sum of squares for each effect in the model and then normalise each estimate by the sum across the effects, forcing the sum to one, with results reported in Columns (2) and (4) of Table 4 for capital gains and rental yields, respectively.

Using capital gains in Middle Atlantic as an example, the combined effect of MSA and time fixed effects is 55%; further decomposition analysis in Column (2) shows that time fixed effects exhibit explanatory power of 44% (which is calculated as  $55\% \times 80\%$ ), whereas MSA fixed effects do so to the tune of 11% (which is calculated as  $55\% \times 20\%$ ). Comparing the results across the housing portfolios based on two-way fixed effects, the conclusion remains consistent with one-way fixed effects that local factors play an essential role in understanding the variation of income return in housing markets.

Furthermore, Beracha et al. (2018) show that time-invariant local amenity in Albouy (2016) is a significant driver of house price “dynamics” in the U.S. MSAs. However, one potential limitation in Beracha et al. (2018) is the lack of time-series dimension for modelling housing price “dynamics.” By incorporating a time-series dimension into a cross-sectional model, the result in Column (4) of Table 4 complements that MSA fixed effects (a proxy for time-invariant local factors) is a key source for understanding variations, particularly in the rental yield.

## 5. Conclusion

Existing studies have typically presumed that the variation in house price changes is mainly driven by local factors, with little attention being paid to its empirical validity. This research bridges this gap by investigating the nature of housing markets from both capital appreciation and income perspectives. Using Zillow data in the U.S., results show that macroeconomic factors, absorbed by time fixed effects in panel data modelling, account for 43% of the variation in capital gains and 2% of the variation in rental yields. The results empirically support the long-held assumption adopted in the literature.

This research adds a new dimension to our understanding about the nature of housing markets. Complementing Glaeser et al.'s (2014) evidence on the capital gain perspective, we further find a more important role of local factors in the income component of housing returns. The finding holds robustly across MSAs of different census division, affordability, population and model specification. The results can provide implications for government interference, balanced national development and portfolio diversification strategy.

Due to data unavailability, most of the empirical research on housing markets is conventionally conducted based on the house price index rather than the total return index. However, housing is mainly a consumption decision, not an investment decision. A resurgence of recent literature addresses the need to incorporate imputed income return into housing analysis (e.g., Bao & Feng, 2018; Brounen et al., 2014; Eichholtz et al., 2021; Jorda et al., 2019; Lin, 2022). Altogether, this research suggests a greater role of local factors in explaining the income returns of housing markets. While housing theory typically argues that housing



markets are local in nature, the need for empirical research to incorporate the income component into the analysis is evident, and may be a fruitful avenue for future research.

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