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ABSTRACT

This research examines whether much of the 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 US metropolitan statistical areas, results show that macroeconomic factors, absorbed by time fixed effects, account for 59% of the variation in capital gains and 4% of the variation in rental yields. Overall, this empirical study is an important complement to the prior literature assuming that the nature of housing markets is primarily local, particularly evidenced in the cross-sectional income returns. The results provide implications for balanced national development and portfolio diversification strategy.

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1. INTRODUCTION

Since the global financial crisis, the impact of house prices on financial markets has driven economists to deepen their understanding of the housing market. The importance of housing cannot be overemphasised, as housing comprises the largest portion of total household wealth in most countries (e.g., Brounen et al., 2014; Poterba, 2000; Xie & Jin, 2015). Changes in housing wealth also substantially affect households' consumption decisions (e.g., Chen et al., 2020; Guo & Hardin III, 2014, 2017). Therefore, governments frequently employ fiscal and monetary policies to influence the housing market. This leads to the long-standing research question of whether most variation in house price changes is mainly subject to national factors. Addressing this question could provide insights into the implications for balanced national development and portfolio diversification strategies.

While standard asset pricing theories in finance advocate 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 area, yet nowhere else). Coskun et al. (2020) conclude a joint role of both market-wide and region-specific factors in driving house price movements. Unlike other financial assets, housing serves as a dual role of investment and consumption good; therefore, homeowners face both financial risk at the national level and consumption hedge effect at the local level (Han, 2013).

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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 scant evidence documented thus far is conducted by Glaeser et al. (2014) and Lin (2018) whose result from the capital appreciation perspective suggests that the variation in house price changes in US metropolitan statistical areas (MSAs) is mainly driven by local factors. A need to investigate the nature of housing markets from an (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 2015 to April 2024 to investigate the nature of housing markets in the US MSAs from both capital appreciation (i.e., sales market) and income return (i.e., rental market) perspectives. Following Glaeser et al. (2014) and Lin (2018), time fixed effects are employed in the panel regression modelling to proxy for macroeconomic factors. Results from rental yields affirm the conclusion of Glaeser et al. (2014) and Lin (2018) that the nature of the housing market is primarily local. In contrast to 59% of the variation in capital gains driven by the national factors, merely 4% of the variation in rental yields is contributed by such factors, suggesting a significantly 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 is followed by a robustness check. The results of housing portfolios of different regional characteristics consistently show that macroeconomic factors account for less than 14% 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. The results remain robust, when MSA fixed effects and a first-order autocorrelation are incorporated into the modelling. Although this study focuses on a few key variables due to the use of monthly data, exploring additional local factors – such as economic, locational and social indicators – that shape housing market conditions could be a valuable avenue for future research.

Overall, we document that local factors are particularly important from an income return (i.e., rental market) perspective. The imputed rental yield mainly relates to households' demand for housing consumption at the local level (Lin, 2022), as the decision to live in an area depends on factors such as birthplace, education, employment and so on. Therefore, it is more influenced by local factors. Conversely, capital appreciation (i.e., the sales market) is more sensitive to macroeconomic shocks, as housing prices can be significantly affected by fiscal and monetary policy. In the US, housing prices became increasing significantly in the late 1990s due to dramatically reduced interest rates. Average housing prices in the US approximately doubled from 1997 to 2007 because of systematic changes in housing finance. Thus, it follows that national factors can be relatively more important in the sales market. Our study confirms this prediction.

More broadly, this research engages with considerable literature on regional house price convergence.[1] 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 the key drivers for the convergence. Moreover, as emphasised by Fairchild et al. (2015), disentangling the influence of national factors from that of local factors in housing is critical, as it helps policymakers, for instance, better understand whether regional housing bubbles can be controlled by adjusting interest rates. Our findings suggest that income returns in housing markets are highly subject to local factors and thus regional policy can be important to regulate consumption demand in housing.

Finally, this work is closely related to Glaeser et al. (2014) and Lin (2018). While they empirically show that the nature of housing markets is largely local based on the evidence of capital appreciation, we complement their findings from both capital appreciation and income

perspectives. The results further indicate that the importance of local factors is 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 from the rental market perspective. The rest of the paper is organised as follows: Section 2 links our work to prior literature, Section 3 describes the data, Section 4 presents the empirical analysis and Section 5 concludes.

2. LITERATURE REVIEW

House price movements are known to be driven by market-wide and region-specific factors. This section discusses these two types of factors.

2.1. National factors

The importance of national factors in housing can be traced back to the well-known Capital Asset Pricing Model (CAPM). The CAPM of Sharpe (1964), Lintner (1965) and Mossin (1966) predicts systematic risk (i.e., the financial risk that cannot be diversified away and is inherent in the entire market) matters most for asset pricing, since investors require compensation for the risk they cannot diversify. While the empirical validity of conventional asset pricing theory has long focused on stock markets, the application of financial theory to real estate cannot be overemphasised, as Roll's (1977) critique indicates that real estate is part of the market portfolio. Hence, similar to financial assets, systematic risk is a key determination of the risk premium of housing assets (Bayer et al., 2010). A series of housing literature by Cannon et al. (2006), Case et al. (2011), Beracha and Skiba (2013), Beracha et al. (2018) and Lin (2022) have empirically confirmed the positive relation between return and systematic risk.

Yet, the true nature of systematic risk can be elusive. Systematic risk is often seen as market risk that broadly captures the impact of macroeconomic factors. These factors play a critical role in the housing market, especially considering the influence of fiscal and monetary policy on housing[2] and its interaction with financial markets. Yang et al. (2018) argue that households make portfolio decisions according to expected housing development and financial market environment. As emphasised by Kim and Cho (2010), the relationship between the housing market and the macroeconomy is critical, especially in the context of policy interventions aimed at promoting housing price stability such as tax breaks and financial assistance. Central banks can also regulate housing prices through monetary policy. An inverse relationship is theoretically expected between house prices and interest rates. Under reduced interest rates, higher housing prices were observed in Hong Kong by Wong et al. (2003) and in the US by Taylor (2007). Turning to unconventional monetary policy shock, changes of central bank total assets affect house prices, mortgage markets and residential supply (Rahal, 2016).

Though housing is traded in the private market, it can also be affected by macroeconomic conditions, information and aggregate sentiment in the public market. Dieci et al. (2018) illustrate that housing investors' participation depends on the market price trends in the stock market. One of the channels to disseminate the information is through news outlets, which are argued to affect readers' beliefs (Shiller, 2005). Soo (2018) quantifies sentiments with news media across US cities and finds sentiment index displays significant predictive power for future house prices. Xia et al. (2020) show that long-run information from economic policy uncertainty and the stock market influences most regional housing markets in China.[3] Simultaneously, ripple effects across regions can lead to housing frenzies at a national level (Chen & Chiang, 2019; Meen, 1999). As emphasised by Tsai (2014, 2015a), regional markets interact with the market on the national scale. Lin and Robberts (2024) further find that a successful inflation targeting policy can promote integration among regions. All of these suggest a crucial interplay between housing and the macroeconomy.

2.2. Local factors

In contrast to financial assets, housing functions as 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). While standard asset pricing theory considers systematic risk the major pricing factor, local factors are particularly essential in housing. The conventional urban models of Alonso (1964), Rosen (1979) and Roback (1982) argue house prices reflect a spatial equilibrium, where prices are driven by local amenities and wages. More precisely, urban models normally model housing location choices, via a bunch of housing and neighbourhood characteristics.

The local fundamentals in real estate markets have received sustained academic attention. Hwang and Quigley (2006) and Beracha et al. (2018) offer a thorough review on this, highlighting several local attributes such as employment, income, population, residential construction activity and so on, to confirm the significance of local conditions to the US metropolitan regions. To expand our horizons of local dynamics, related indices are established. For instance, local amenity indices in Albouy (2016) is an aggregate measure of the attributes important to consumer and firm location decisions, and the land share value index in Davis and Palumbo (2008) can explain the evolution of residential land values. To underscore the significance of the local housing supply in shaping the market, Gyourko et al. (2008, 2019) offer a ranking of regional markets regarding their regulatory restrictiveness, and Saiz (2010) provides operational estimates of local supply elasticities.

Understanding local factors is important, since households make decisions for homeownership based on local markets within which they reside. Homeownership can be viewed as insurance against fluctuations in future rent payments (Sinai & Souleles, 2005). Guo and Hardin III (2017) further document that in the long-term, homeownership serves as a cushion to the fluctuation of cash flow or household income to maintain 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 III, 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 a lower return in housing to compensate future consumption risk. As emphasised by Lin (2022), the income return is more closely linked to the consumption hedging demand at the local level.

Besides economic fundamentals, locational and social factors are important in housing. Applying local amenity indices from Albouy (2016), Beracha et al. (2018) confirm that access to local amenities is an important channel to understanding house price dynamics. The amenities can impact housing values through positive or negative externalities, depending on the circumstance. For example, Diamond and McQuade (2019) show that the Low-Income Housing Tax Credit programme in the US has heterogeneous impacts on local house prices. In areas with low income or high minority shares, house prices appreciate significantly in the long-term following the introduction of affordable housing projects.

2.3. Research motivation

Fundamentally, house price changes are mostly influenced by macroeconomic factors according to classical asset pricing models. However, the heterogeneity in house price changes across regions is driven by local supply and demand, based on standard urban models. Though a body of literature such as Hwang and Quigley (2006), Han (2013) and Glaeser et al. (2014) conform to the viewpoint that the variation in house price changes is primarily 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 US 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 shed light on the nature of housing markets from both capital appreciation and income perspectives. We expand on existing literature by examining capital appreciation in the sales market alongside the rental market from the income perspective (or the implicit rents of owner-occupiers). According to Lin (2022), the income component of housing returns is closely tied to local consumption demands, as the decisions to reside in a particular area are influenced by factors such as birthplace, education, employment and so on. Conversely, capital appreciation is more sensitive to macroeconomic shocks, with housing prices significantly affected by fiscal and monetary policies. Therefore, national factors are likely to be more important for capital appreciation than for income returns.

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 US.

The Zillow Home Value Index is further paired with the Zillow Observed Rent Index over the period January 2015 to April 2024, leading to a sample of 183 MSAs. The rent index is computed through changes in asking rents over time, adjusting for changes in the quality of the available rental stock. Table 1 presents the descriptive statistics of capital gains and rental yields across MSAs. Consistent with Jorda et al. (2019), the rental yields are larger than the capital gains across MSAs, since income return is a key source of return in housing assets.

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, appraising rents of homeowners may involve survey errors (Jorda et al., 2019). Hence, the results shall be interpreted with caution, particularly when trends in the explicit rental price of tenant-occupied housing are inconsistent with the implicit rental price of owner-occupied housing (Lin, 2022).

4. EMPIRICS: NATURE OF HOUSING MARKETS

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

Table 1. Summary statistics of housing returns across MSAs.

	Mean (%)	SD (%)	Min (%)	Max (%)	Obs
Capital gains	0.36	0.58	−2.44	4.30	20,313
Rental yields	0.51	0.11	0.25	0.94	20,313

Notes: The monthly housing and rent indices are collected from Zillow over 2015:M1 to 2024:M4. 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).

4.1. Research methodology

To quantify the importance of national factors in housing markets, the following panel data regression is estimated, following Glaeser et al. (2014) and Lin (2018):

$$Housing\ Market_{i,t} = c + \beta_t + \varepsilon_{i,t}, \tag{1}$$

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 explained variables and β_t denotes month fixed effects.

To assess the nature of housing markets, we treat the time fixed effects as the key explanatory variable only, which enables us to compare the result directly against Glaeser et al. (2014). The unobserved effect of macroeconomic shocks at the broader national level, such as changes in interest rates and tax codes, can be captured by time fixed effects in panel data analysis. Hence, Han (2013) and Glaeser et al. (2014) regard time fixed effects as a proxy to control for the impact of time-varying macro shocks. The approach allows us to directly decompose the relative significance 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, along with a lagged return term:

$$Housing\ Market_{i,t} = c + \alpha_i + \beta_t + Housing\ Market_{i,t-1} + \varepsilon_{i,t}, \tag{2}$$

where α_i denotes MSA fixed effects and β_t denotes month fixed effects. The lagged housing return term, $Housing\ Market_{i,t-1}$, is used to capture potential inefficiencies in real estate markets. A conventional approach of modelling MSA fixed effects employs MSA dummies to allow the intercept to vary across regions, while modelling of time fixed effects employs month dummies to allow the intercept to differ across time periods. Besides controlling the unobserved effect of common macro shocks, Equation (2) further incorporates the unobserved impact of time-invariant shocks at the regional level (such as geographical supply constraints and locations), which is captured by MSA fixed effects (Favara & Imbs, 2015; Han, 2013). Next, based on the baseline model, we decompose the variation in housing returns contributed by various factors by employing 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) note 'barely more than one quarter of the variation in price changes across cities can be accounted for by national, year-specific fixed effects'.[4] Using a different dataset from Zillow, the results in Table 2 from an income return perspective affirm Glaeser et al.'s (2014) conclusion that the nature of housing markets is largely local, given that 4% of the variation in rental yields are explained by national, month-specific fixed effects.

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

	Capital gain	Rental yield
Model fitness	59%	4%

Notes: Table 2 presents the result of R-squared based on Equation (1): $Housing\ Market_{i,t} = c + \beta_t + \varepsilon_{i,t}$ with the application of monthly data from 2015:M1 to 2024:M4. All the variables are in real terms, deflated by the net-of-shelter consumer price index published by the BLS.

4.2.1. 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.[5] 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 14% of the variation in the rental yields except for the West North Central Division. Turning to population, it shows that areas with more population are more subject to macroeconomic factors, as evidenced in both capital gains and rental yields. Interestingly, the results indicate that the variation in capital gains contributed by time fixed effects is slightly higher in expensive areas. This might possibly imply a higher impact of macroeconomic shocks in less affordable sales markets, via the channels like fiscal or monetary policy. Overall, the results emphasise a key role of local factors in understanding the variation of income return in housing markets.

Taylor (2007) posits that monetary policy plays an important role in determining housing prices. Our empirical exploration confirms the significant role of macroeconomic factors in the sales market, although the results can vary across housing portfolios. According to Meen (1999), greater debt gearing in an area implies that households can be more vulnerable to changes in interest rates. Concurrently, we observe that macroeconomic factors have a greater influence on more expensive sales markets, where higher debt gearing is more likely to occur. On the other hand, Sun and Tsang (2018) argue that more regulated markets tend to be more responsive to monetary shocks. Thus, significant heterogeneity in the behaviour of housing markets across MSAs in response to macroeconomic factors can be linked to the underlying structures of local markets. Therefore, to effectively reshape the housing market through fiscal and monetary policy, the central government would need to cooperate with local governments, as several factors can interplay in this process.

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

	Capital gain	Rental yield
Panel A: Census division		
Pacific	77%	8%
Mountain	64%	13%
New England	76%	4%
South Atlantic	67%	9%
Middle Atlantic	71%	6%
East North Central	80%	12%
East South Central	71%	12%
West North Central	78%	36%
West South Central	47%	7%
Panel B: Affordability		
Affordable	62%	6%
Expensive	64%	5%
Panel C: Population		
Small	56%	3%
Large	62%	7%

Notes: Table 3 presents the result of R-squared based on Equation (1): $Housing\ Market_{i,t} = c + \beta_t + \varepsilon_{i,t}$ with the application of monthly data from 2015:M1 to 2024:M4. 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.

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

	(1) Model fitness: Capital gain	(2) Variance decomposition: Month fixed effects (MSA fixed effects)	(3) Model fitness: Rental yield	(4) Variance decomposition: Month fixed effects (MSA fixed effects)
Panel A: Census division				
Pacific	78%	98% (2%)	96%	9% (91%)
Mountain	64%	96% (4%)	96%	14% (86%)
New England	77%	96% (4%)	95%	4% (96%)
South Atlantic	71%	92% (8%)	95%	9% (91%)
Middle Atlantic	70%	98% (2%)	96%	6% (94%)
East North Central	83%	95% (5%)	97%	12% (88%)
East South Central	73%	94% (6%)	95%	12% (88%)
West North Central	79%	96% (4%)	97%	38% (62%)
West South Central	52%	86% (14%)	91%	8% (92%)
Panel B: Affordability				
Affordable	67%	92% (8%)	96%	6% (94%)
Expensive	67%	94% (6%)	97%	5% (95%)
Panel C: Population				
Small	60%	91% (9%)	98%	3% (97%)
Large	66%	93% (7%)	97%	7% (93%)

Notes: Table 4 presents the result of adjusted R-squared based on Equation (2) without lagged housing returns: $Housing\ Market_{i,t} = c + \alpha_i + \beta_t + \varepsilon_{i,t}$ with the application of monthly data from 2015:M1 to 2024:M4. 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.

4.2.2. Robustness check: other factors

For alternative robustness check, we consider a linear unobserved effects model with two-way fixed effects (i.e., MSA and month fixed effects). While the approach of a 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 the modelling as highlighted in Lin (2018). However, due to the 'monthly' data used in this study, it is infeasible to find local factors of the

Table 5. Impact of AR(1) with two-way fixed effects on housing portfolios.

	(1) Model fitness: Capital gain	(2) Variance decomposition: Month fixed effects (MSA fixed effects) [AR(1)]	(3) Model fitness: Rental yield	(4) Variance decomposition: Month fixed effects (MSA fixed effects) [AR(1)]
Panel A: Census division				
Pacific	79%	97% (3%) [0%]	100%	2% (0%) [98%]
Mountain	66%	91% (6%) [3%]	100%	1% (0%) [99%]
New England	80%	91% (6%) [3%]	100%	2% (0%) [98%]
South Atlantic	73%	91% (7%) [2%]	100%	1% 0% [99%]
Middle Atlantic	70%	96% (3%) [1%]	100%	2% (0%) [98%]
East North Central	83%	95% (5%) [0%]	100%	2% (0%) [98%]
East South Central	77%	88% (8%) [4%]	100%	1% (0%) [99%]
West North Central	80%	95% (4%) [1%]	100%	3% (0%) [97%]
West South Central	52%	87% (13%) [0%]	100%	0% (0%) [100%]
Panel B: Affordability				
Affordable	68%	90% (9%) [1%]	100%	1% (0%) [99%]
Expensive	68%	92% (7%) [1%]	100%	1% (0%) [99%]
Panel C: Population				
Small	62%	88% (10%) [2%]	100%	1% (0%) [99%]

(*Continued*)

Table 5. Continued.

	(1) Model fitness: Capital gain	(2) Variance decomposition: Month fixed effects (MSA fixed effects) [AR(1)]	(3) Model fitness: Rental yield	(4) Variance decomposition: Month fixed effects (MSA fixed effects) [AR(1)]
Large	67%	92% (7%) [1%]	100%	1% (0%) [99%]

Notes: Table 5 presents the result of adjusted R-squared based on Equation (2): $Housing\ Market_{i,t} = c + \alpha_i + \beta_t + Housing\ Market_{i,t-1} + \varepsilon_{i,t}$ with the application of monthly data from 2015:M1 to 2024:M4. 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.

same frequency. To address this issue, following Lin (2022), 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.

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 contributed by MSA and month fixed effects through ANCOVA. We calculate the partial sum of squares for each effect in the model and next 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 the South Atlantic as an example, the combined effect of MSA and month fixed effects is 71%; further decomposition analysis in column (2) shows that month fixed effects exhibit an explanatory power of 65% (which is calculated as 71% × 92%, or the R-squared multiplied by the percentage of contribution from the corresponding effect), whereas MSA fixed effects do so to the tune of 6% (which is calculated as 71% × 8%). 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.

By using the MSA fixed effects as the proxy for time-invariant local factors, our findings on rental yields align with those of Beracha et al. (2018), who demonstrate that time-invariant local amenities, as identified by Albouy (2016), are crucial for understanding regional house price dynamics in the US. However, a limitation of Beracha et al. (2018) is their lack of a time-series dimension in modelling housing price dynamics, as their analysis relies on a cross-sectional model. To address this, we control dynamics in the modelling.

4.2.3. Robustness check: temporal autocorrelation

Housing markets are typically known to be inefficient (Case & Shiller, 1989) and exhibit positive autocorrelation in the returns (Case & Shiller, 1990). Thus, following Han (2013), we incorporate lagged housing returns into the modelling to capture potential inertia in house price movement. Consistent with the results in the previous tables, Table 5, using a first-order autoregressive model (AR(1)), shows that local factors remain mostly important,

particularly in the rental yield. In this setting, it is interesting to note that the significance of regional fixed effects is absorbed by AR(1). This is expected, as rents are sticky contractual income streams (Lizieri, 2013).

4.3. Implications

Understanding the significance of common factors driving housing markets can assist policy makers in alleviating regional imbalances and institutional investors in constructing portfolio diversification strategies (Antonakakis et al., 2018). From the policy perspective, policy makers are interested in the temporal and geographic diffusion of macroeconomic shocks and effectiveness of national policy (Cotter et al., 2015). While national factors remain important in housing, our results complement that income return in housing is particularly subject to the local risk. This suggests that regional policy can have a beneficial effect on regulating the local consumption demand of housing. From the finance perspective, diversification benefits are limited, if regional housing prices are mainly subject to systematic risk (Gholipour & Lean, 2017). Our finding of little systematic risk in regional income return suggests a major source of diversification benefits for institutional investors.

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, as a first attempt, bridges this gap by investigating the nature of housing markets from both capital appreciation and income perspectives. Using Zillow data in the US, results show that macroeconomic factors, absorbed by time fixed effects in panel data modelling, account for 59% of the variation in capital gains and 4% of the variation in rental yields. The result from the rental market empirically supports 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) and Lin's (2018) evidence on the capital gain perspective, we further find a far more significant role of local factors in the income component of housing returns. The finding holds robustly across MSAs of different census divisions, affordability, population and model specification. The results can provide implications for balanced national development and the portfolio diversification strategy.

Due to data unavailability, most empirical research on the 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 that the income returns of the housing markets are remarkably driven by local factors. 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.

DATA AVAILABILITY

Publicly available data (i.e., not vendor data) that support the findings of this study are available upon request from the author.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s).

NOTES

[1] 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] 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).

[3] 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).

[4] 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 Bureau of Labour Statistics (BLS).

[5] Consistent with Lin (2022), the rank of population statistics of each MSA is provided in the Zillow dataset and the median house price is used as the proxy for housing affordability. Then, the median of population ranking and housing affordability across MSAs is used as a cut-off point for the housing portfolios between affordable and expensive areas, or between small and large populations.

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