

IMPACT OF REAL ESTATE INVESTMENT TRUSTS ON HOUSING PRICES IN THE
U.S.

A THESIS

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By:

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IMPACT OF REAL ESTATE INVESTMENT TRUSTS ON HOUSING PRICES IN THE U.S.

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Mathematical Economics

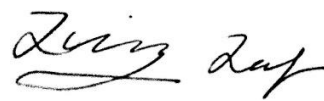
Abstract

This paper examines the impact of real estate investment trusts (REIT), that invest in residential properties, on U.S. housing prices. Using a U.S. monthly time-series dataset, from February 2012 to December 2023 with data on home prices as a function of REIT performance, and other national macroeconomic control variables the results of a two-stage least squares (2SLS) model support a positive and statistically significant causal relationship between the growth of Equity Residential REITs and single-family home prices in the United States.

KEYWORDS: (Real Estate Investment Trusts, Housing Market, Home Affordability)

JEL CODES: (R21, R31)

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED
UNAUTHORIZED AID ON THIS THESIS

A handwritten signature in cursive script, appearing to read "Zing Zang", written in black ink.

Signature

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1. Introduction

The nexus between Real Estate Investment Trusts (REITs) and housing prices in the United States represents a pivotal concern for both economic scholars and policymakers, given its implications on home affordability and, by extension, societal wellbeing. A recent survey found 49% of Americans worried about being able to afford housing (Pew Research Center, 2021). REITs, many of which are publicly-traded, operate as investment vehicles, giving investors the opportunity to pool their funds, which are then invested into the real estate sector.

While some REITs invest specifically in real estate derivatives, such as Mortgage-Backed Securities and Mortgage Servicing Rights, a certain category of REITs, namely Equity Residential REITs, operate primarily by acquiring equity in, or purchasing, residential properties. The burgeoning growth of REITs since the 1990s, with the market capitalization of REITs in North America increasing from \$8.7 billion in 1990 to \$1.9 trillion in 2022 (Nareit, 2022), and their increasingly prevalent role in the real estate market necessitates a thorough examination to understand their influence on housing affordability.

While REITs are often seen as a progressive financial innovation facilitating capital inflows to the real estate sector, this paper endeavors to scrutinize the causal relationship between the growth of REITs and housing prices in the U.S., using national data and macroeconomic control variables reported on a monthly frequency. Recently, nationwide home prices were found to be increasing about two times as fast as real wage growth (LBM Journal, 2023). This suggests that the increased presence of institutional investors in the residential real estate market through REITs may be a contributing factor to this surge in home unaffordability. Based on the empirical

findings of preceding studies on the topic, this paper hypothesizes that the growth of REITs has a positive causal relationship with nationwide housing prices,

The paper will proceed as follows: the next section will look at and draw insights from existing literature relevant to the topic. Next, the underlying theory, including the theoretical framework and the empirical model, will be presented. The subsequent chapter will discuss, describe, and defend the data used in the paper. Finally, the last chapter will present the results obtained from the study and discuss the conclusions that can be drawn from the paper's empirical findings.

2. Literature Review

The U.S. housing market has undergone significant transformations, with various factors influencing home affordability. Among these, the growth of Real Estate Investment Trusts (REITs), and the associated impacts on housing affordability, has emerged as a focal point of research. This research seeks to add to the existing literature by analyzing this relationship within the U.S. based on a monthly frequency, while controlling for macroeconomic factors.

Banti and Phylaktis (2021) embarked on a comprehensive exploration of REITs, emphasizing their rapid growth since the 1990s. Their primary objective was to understand the evolution of REITs and assess their influence on housing prices. Utilizing a combination of quantitative models and empirical data, they meticulously analysed the growth trajectory of REITs. Their methodology involved correlating REIT growth with housing price trends over the years. The findings were illuminating: while REITs have provided lucrative investment opportunities, they have inadvertently contributed to housing unaffordability, especially in densely populated urban areas.

Capellan et al. (2020) delved into the nuanced relationship between REITs and housing prices in the context of local real estate markets in Spain. Their research aimed to identify correlations and causations, especially focusing on the impact of foreign investors investing in real estate through REITs activity. The results were clear: regions with high REIT activity witnessed a significant increase in housing prices. This correlation was particularly strong in areas where REITs have a dominant presence, suggesting their undeniable influence on housing market dynamics.

Cannon & Cole (2008) turned their attention to the liquidity aspects of REITs, looking at how these aspects varied between 1988 to 2007. Their objective was to

understand the determinants of REIT liquidity and its fluctuations over the years. By using a panel dataset comprised of data on U.S.-based REITs, the study provided support for the idea of using REIT performance as a proxy for institutional investor activity in the real estate sector. Additionally, this study lays the groundwork for determining the appropriate lag periods to implement during model selection. In particular, it implies that for publicly-traded REITs, and therefore indices that track publicly-traded REITs, the Efficient Market Hypothesis applies, wherein the current market price can be said to be reflective of all publicly available information.

Fields & Uffer (2014) embarked on a comparative analysis journey, focusing on the financialization of rental housing in New York City and Berlin. Their objective was to explore the transformative effects of private equity real estate investment on urban rental housing landscapes. By adopting a case study approach and leveraging qualitative data, they painted a vivid picture of the rental housing markets in these cities. Their findings highlighted the profound impact of financialization, with private equity investments reshaping the dynamics of rental housing in both cities.

Gorback & Keys (2020) set out to investigate the effects of foreign capital inflows on the U.S. housing market. Their research was anchored in understanding the rise in foreign purchases of U.S. residential real estate and its implications on home prices, analysing transaction data from the housing market as part of their research methodology. The results were telling: there was a significant rise in foreign purchases, especially in prime real estate locations. Their exploration into the impact of foreign buyer taxes provided insights into potential policy measures to regulate housing prices and, in the context of my research question, provided valuable insight into how to control for supply in the quest to find the isolated impact of institutional investing on housing prices.

Lambie-Hanson et al. (2019) focused on the post-2007 sub-prime mortgage crisis housing market. They documented the increasing presence of institutional investors and linked their rise to the recovery in house prices and the decline in homeownership rates. By leveraging property-level transaction data, they delved deep into the dynamics of the housing market in a recessionary environment. Their findings were profound: the increasing presence of institutional investors was directly linked to the recovery in house prices. This paper provides support for the hypothesis developed in my study concerning the potential causal relationship between institutional investing in residential real estate through REITs and home affordability.

Basak & Pavlova (2016) turned their attention to the financialization of commodities. Their objective was to understand the influx of institutional funds into commodity futures markets and its subsequent impact. By developing a multi-good, multi-asset dynamic model, they provided a theoretical framework to analyse the phenomenon. Their findings revealed that all commodity futures prices increased with financialization, with a more pronounced effect for commodities included in popular indices. This research provides support for my study's hypothesis by demonstrating how financial shocks roll over from derivative markets to commodity markets.

Nishigaki (2007) provided additional insights relevant to my research question by studying the correlation between the performance of the U.S. REIT market and national housing prices. The findings highlighted the distinct characteristics of the U.S. REIT market, identifying a stronger positive correlation between the two variables. More importantly, the use of inflation and long-term interest rates as control variables in the model provided insights into the selection of macroeconomic controls when studying this relationship.

In the quest to determine the appropriate lags and leads for my model specification, Clayton et al. (2010) provided some valuable insight. The paper, which sought to study the lag-lead relationship between housing supply, or trading volume, and home prices, found that home prices lagged the proxy for housing supply, with the optimal lag period depending on regional and local factors.

In conclusion, the existing literature has provided foundational insights into the dynamics of REITs and housing affordability. The upcoming research, with its unique approach and variables, promises to fill this gap, offering fresh insights into the monthly dynamics of REITs and their impact on housing affordability in the U.S. while controlling for macroeconomic factors.

3. Theory

3.1. Theoretical Framework

The theoretical foundation of this research is deeply rooted in the existing literature around the economic and financial dynamics that govern the U.S. housing market. Real Estate Investment Trusts (REITs), as specialized investment vehicles, have emerged as significant players in this landscape. Their growth and influence on housing prices and affordability form the crux of this study.

This paper incorporates the basics of supply and demand theory in the context of housing prices. To study the marginal impact of REIT performance on home affordability, the dependent variable, that serves as the measure for real home prices in the U.S., is seen as a function of a proxy for REIT growth, consumer income levels, and housing supply. Based on sound theory, consumer income levels and REIT growth can be assumed as exogenous variables that can themselves affect housing prices significantly. However, housing supply can not be assumed as independent as literature, such as Fingleton (2008), suggests that it is correlated with the error term of this proposed model. Therefore, to account for this endogeneity in the model, the variable for housing supply had to be paired with an instrumental variable and a two-stage least squares (2SLS) regression model was used in lieu of a conventional Ordinary Least Squares (OLS) model.

The underlying theory for this proposed model is based on existing literature. For instance, Banti and Phylaktis (2021), when looking at the relationship between housing price trends and REIT returns in various advanced and emerging economies, controlled for the interest rate environment, consumer purchasing power, and other general macroeconomic trends. Their findings suggest that the improved performance

of REITs, especially in residential properties, can exert upward pressure on housing prices. They also find that this effect is particularly pronounced in advanced economies, such as the United States.

Furthermore, Murphy (2010) tested for and found that housing supply was impacted by macroeconomic conditions, particularly costs associated with real estate construction. This was the supporting theory for specifying housing supply as an instrumental variable which was determined in the first stage of the 2SLS model, by regressing housing supply against mortgage rates, construction costs, consumer income levels, and U.S. population.

The FTSE NAREIT Equity & Residential REIT Index (FT17) serves as a pivotal variable in this theoretical exploration. This index encapsulates the growth of equity REITs that predominantly invest in residential properties. Building on this, the research assumes this index to serve as a robust proxy for the REIT sub-sector most relevant to the research question, which, in turn, might be correlated with rising housing prices.

However, the dynamics of the housing market are multifaceted. In addition to Murphy (2010), Capellan et al. (2020) also provided a support for a similar perspective, exploring the intricate interplay between REITs and housing prices in the context of a local residential real estate market in Spain. Their research illuminated the need to control for supply fluctuations, which themselves were related to construction costs, when estimating the REIT-housing prices relationship. Their findings serve as a reminder that while REITs are influential, they operate within a broader ecosystem of economic and financial variables. This underscores the importance of incorporating Median Disposable Income, a proxy for consumer purchasing power, into the model.

Fields & Uffer (2014) looked at this question through the lens of the financialization of rental housing, especially in urban centers like New York City and Berlin. They also found a negative correlation between the increased prevalence of REITs in rental real estate and home affordability in these urban centers. In their study, they also controlled for fluctuations in the credit markets.

In conclusion, this theoretical framework seeks to weave together the insights and findings from a rich tapestry of prior research. By integrating these perspectives and grounding them in the unique focus and variables of this study, the research aims to offer a holistic understanding of the intricate relationship between REIT growth and housing affordability in the U.S.

3.2. Empirical Model

As mentioned before, a 2SLS regression model is used to address the endogeneity between housing supply ($\ln\text{HomeInventory}$) and real home price (RealHomePrices lagged). Therefore, the first stage of the model is used to generate fitted values for housing supply using the following regression equation:

$$\begin{aligned} \text{Equation 1: } \ln\text{HomeInventory}_t = & \mu_0 + \mu_1 \times \text{MortgageRates}_t + \\ & \mu_2 \times \text{ConstructionIndex}_t + \mu_3 \times \text{RealDisposableIncome}_t + \\ & \mu_4 \times \text{PopulationLevel}_t + v_t \end{aligned}$$

Where $\ln\text{HomeInventory}_t$ is the natural log of the monthly reading of the number of single-family homes and condominium units available for sale in the U.S. in month t . The reason for using the natural log of HomeInventory in the model was to make the model more in line with the Gauss-Markov assumption of normality of the error term, and this specific Box-Cox transformation provided a better fit. The dependent variable was predicted by: 1) MortgageRates_t , are given by the start-of-

month average rate on 30-year fixed rate mortgages in the U.S. in month t , 2) $ConstructionIndex_t$, representing the start-of-month producer price index for net inputs to residential construction in month t , 3) $RealDisposableIncome_t$, representing the inflation-adjusted monthly reading of per capita disposable income in the U.S. in month t , 4) the instrument $PopulationLevel_t$, representing the monthly reading of the number of civilians in the U.S. over the age of 16 in month t , and 5) v_t , representing the error term for the model. $PopulationLevel_t$ is chosen as an instrument because it is highly correlated with $lnHomeInventory_t$ but uncorrelated with the error term ε_t in equation (2).

The fitted values of $lnHomeInventory_t$ from equation 1 called $PredictedlnHomeInventory_t$ are used in equation 2. The instrumental variable fulfils the relevance condition, wherein it is correlated to the variable being instrumented ($lnHomeInventory_t$), and the exogeneity condition, wherein it is uncorrelated with the error term ε_t in equation 2.

Therefore, the following regression model is used in the second stage:

$$\text{Equation 2: } RealHomePrices_{t-1} = \beta_0 + \beta_1 \times REITIndex_t + \beta_2 \times RealDisposableIncome_t + \beta_3 \times PredictedlnHomeInventory_t + \varepsilon_t$$

Where $RealHomePrices_{t-1}$ is the one-month lagged monthly reading, adjusted for inflation, of the median single-family home price in the U.S., in month t as predicted by: 1) $REITIndex_t$, representing the start-of-month reading of the FTSE NAREIT Equity & Residential REIT Index (FT17) in month t , 2) $RealDisposableIncome_t$, representing the inflation-adjusted monthly reading of per capita disposable income in the U.S. in month t , 3) $PredictedHomeInventory_t$, the

instrumental variable that is calculated in the first stage of the 2SLS model, and 4) ε_t , representing the error term for the model.

The first step of determining the appropriate lag periods involved invoking the Efficient Market Hypothesis and comparing the availability, accuracy, and frequency of information for the markets from which the variables in my model are derived. Based on theory and existing literature, the real estate market for homes was assumed to be less efficient due to liquidity and transactional constraints. Furthermore, studies such as Clayton et al. (2010), provided empirical evidence for this lag-lead relationship between prices and supply in the real estate market. In other words, due to inefficiencies in the housing market, home prices were shown to be slightly delayed in reacting to supply, macroeconomic, or investment fluctuations. For the real housing prices, which serve as the dependent variable in my model, the optimal lag period was determined to be one month, or approximately four weeks, in line with the two-to-ten-week estimate suggested by existing literature.

Lastly, to account for the effect of inflation on housing prices, the dependent variable was adjusted for inflation using the Core Consumer Price Index (CPI). The following expression was used to adjust the nominal values of the housing price variable:

$$\text{Equation 3: } RealHomePrices_t = \frac{NominalHomePrices_t \times CoreCPI_{base}}{CoreCPI_t}$$

Where the $CoreCPI_{base}$ was indexed to 100 in the month of February 2012.

4. Data

The primary data sources for this study, all of which are recorded on a monthly frequency, include the: 1) Single-Family Home Prices, which measure the median price of single-family homes and condominiums in the U.S.,¹ 2) Sticky Price Consumer Price Index, which measures the price level of consumers in the U.S. while excluding the volatile price categories of food and energy,² 3) Total Housing Inventory, which tracks the number of nationwide for-sale listings of single-family homes and condominiums,³ 4) the FTSE NAREIT Equity & Residential REIT Index (FT17), which is an index that measures the performance of publicly-traded equity REITs that predominantly invest in residential properties in the U.S.,⁴ 5) the Producer Price Index: Net Inputs to Residential Construction, an index that tracks the cost of raw materials for producers of residential housing units in the U.S.,⁵ 6) Per Capita Real Disposable Personal Income, which tracks the per capita income level in the U.S.,⁶ 7) Population Level, which represents the number of civilians in the U.S. above the age of 16,⁷ and 8) Average 30-Year Fixed Rate Mortgage Rates, which represents the average mortgage rates for 30-year fixed rate mortgages in the U.S.⁸

The strength of the Single-Family Home Prices lies in its comprehensive coverage and the fact that it tracks the affordability of the most commonly applicable segment, single-family homes, of the housing market, making it a reliable and

¹ Available at <https://tradingeconomics.com/united-states/single-family-home-prices>.

² Available at <https://fred.stlouisfed.org/series/CORESTICKM159SFRBATL>.

³ Available at <https://tradingeconomics.com/united-states/total-housing-inventory>.

⁴ Available at <https://finance.yahoo.com/quote/%5EFN17/history>.

⁵ Available at <https://fred.stlouisfed.org/series/WPUIP2311001#0>.

⁶ Available at <https://fred.stlouisfed.org/series/A229RX0>.

⁷ Available at <https://fred.stlouisfed.org/series/CNP16OV>.

⁸ Available at <https://fred.stlouisfed.org/series/MORTGAGE30US>.

representative indicator of housing price trends. Sticky Price Consumer Price Index (Core CPI) data from a reputable source like the Bureau of Labor Statistics ensures accuracy in adjusting the Single-Family Home Prices, which is a nominal variable, for inflation. The theoretical reasoning for choosing the Sticky Price Consumer Price Index over the Consumer Price Index, which includes the volatile categories of food and energy, laid in the fact that our variable to be adjusted, the Single-Family Home Prices, tracks a ‘good’ that is durable and infrequently bought, making the Core CPI a more appropriate fit.

To adequately account for the effects of supply in the model, the Total Housing Inventory dataset does an adequate job of acting as a proxy for housing supply. Since it is specifically directed towards single-family homes and condominiums, it aligns well with the Single-Family Home Prices data and appropriately account for supply fluctuations in the model.

The FT17 Equity Residential index, measured by the National Association of Real Estate Investment Trusts (NAREIT), is a robust measure of REIT performance and specifically hones in on a sub-sector of the REIT industry most relevant to this paper; equity residential. This means that the FT17 index specifically tracks the performance of REITs that predominantly invest in residential properties, the prices of which are themselves tracked by the Single-Family Home Prices variable.

The use of a producer price index that tracks the cost of inputs specific to residential construction as an instrument for housing supply ensures that the most relevant measure of construction costs is incorporated into the model. Additionally, using per capita real disposable income as a proxy of consumer income levels is beneficial as this variable removes taxation considerations and is, therefore, a good

proxy for consumer purchasing power. However, one potential weakness is that these data sources, which are measured on the national level, may not capture the full complexity of local housing markets and wage variations at the state or city levels, something that was accounted in multiple prior studies, such as Murphy (2010), Fields and Uffer (2014), and Capellan et al. (2020).

Overall, the comprehensive dataset for this study comprises monthly observations from February 2012 to December 2023, for a total observation count of 142. Descriptive statistics are shown below:

TABLE I. *Descriptive Statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
NominalHomePrices	142	267678.87	68920.367	155600	416000
RealHomePrices	142	217264.77	56124.242	116392.42	433071.8
RealHomePricesLagg~1	141	217531.2	56234.135	116392.42	433071.78
REITIndex	142	343.713	98.337	148.808	667.688
RealDisposableIncome	142	45831.937	3694.748	40526	61509
HomeInventory	142	1716.338	435.827	860	2500
lnHomeInventory	142	7.412	.279	6.757	7.824
MortgageRates	142	4.167	1.077	2.684	7.62
ConstructionIndex	142	115.628	18.468	98.779	157.321
PopulationLevel	142	255683.73	7053.928	242604	267991
Year	142	2017.577	3.426	2012	2023
Month	142	6.57	3.436	1	12
CoreCPI	142	139.969	64.761	75.167	327.879

5. Results

5.1. Empirical Findings

TABLE II. 2SLS Estimation Results

RealHomePricesLagged1	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnHomeInventory	193529.86	80361.991	2.41	.016	36023.25	351036.47	**
REITIndex	631.461	59.382	10.63	0	515.074	747.848	***
RealDisposableIncome	3.512	1.605	2.19	.029	.365	6.658	**
2012b	0	.	.	.	.	.
2013	44665.367	10391.981	4.30	0	24297.459	65033.275	***
2014	24026.208	9179.419	2.62	.009	6034.878	42017.539	***
2015	2661.309	9616.841	0.28	.782	-16187.354	21509.972	
2016	7167.454	12113.56	0.59	.554	-16574.687	30909.594	
2017	12275.515	16121.873	0.76	.446	-19322.776	43873.805	
2018	36790.096	20103.806	1.83	.067	-2612.64	76192.831	*
2019	-8994.902	19328.275	-0.47	.642	-46877.625	28887.822	
2020	61797.396	33933.501	1.82	.069	-4711.044	128305.84	*
2021	88815.029	48326.039	1.84	.066	-5902.267	183532.33	*
2022	132622.04	62287.231	2.13	.033	10541.306	254702.77	**
2023	146803.07	67697.522	2.17	.03	14118.365	279487.78	**
Month : base 1	0	.	.	.	.	.
2	4995.472	8477.352	0.59	.556	-11619.832	21610.776	
3	-9452.072	8784.756	-1.08	.282	-26669.877	7765.734	
4	-16094.981	9914.392	-1.62	.105	-35526.831	3336.87	
5	-25819.622	14381.506	-1.80	.073	-54006.856	2367.612	*
6	-28925.917	16721.242	-1.73	.084	-61698.95	3847.116	*
7	-30862.328	17464.543	-1.77	.077	-65092.205	3367.548	*
8	-21993.043	18296.48	-1.20	.229	-57853.484	13867.399	
9	-13399.708	16756.704	-0.80	.424	-46242.245	19442.828	
10	-14535.841	15505.481	-0.94	.349	-44926.025	15854.344	
11	-19373.447	14191.242	-1.37	.172	-47187.771	8440.877	
12	-11434.027	10493.064	-1.09	.276	-32000.054	9132	
Constant	-1625544.3	612942.92	-2.65	.008	-2826890.3	-424198.25	***
Mean dependent var		217531.205	SD dependent var			56234.135	
R-squared		0.875	Number of obs			141	
Chi-square		1029.405	Prob > chi2			0.000	

*** $p < .01$, ** $p < .05$, * $p < .1$

Overarchingly, the results demonstrate statistical significance at the 95% confidence interval for all variables in the model and the obtained coefficient for the variable of interest supports the hypothesis being tested. The variable of interest, the REIT Index, is shown to be positively correlated with the dependent variable. According to the model's estimation, a one-unit increase in the REIT Index is shown to, on average, result in a marginal increase of \$613 in the real median price of single-family homes in the U.S., keeping all other predictors constant.

Similarly, Real Disposable Income is also shown to have a positive and statistically significant relationship with Real Home Prices, although the smaller magnitude of the coefficient suggests a somewhat weaker relationship. Before interpreting the coefficient for Home Inventory, it is pertinent to mention that this predictor underwent a linear-log transformation in the regression model, the reason for which I explain below. Therefore, since the natural log of Home Inventory was used in the model, the interpretation of the coefficient is based on the following expression:

$$\text{Change in Real Home Prices for 1\% increase in Home Inventory} = \frac{\beta_i}{100}$$

This implies that, on average, a 1% increase in Home Inventory will result in a \$1935 real increase in median single-family home prices, assuming all other predictors are constant.

To test for whether or not the excluded instruments in the overidentified equation are appropriately independent of the error term, the Sargan Test was conducted. The model registered a Sargan score of 2.36, which led to the failure in rejecting the null hypothesis. Since the null hypothesis is that the instruments are uncorrelated with the error term, the model passed the Sargan test.

TABLE III: Sargan Test Results

Tests of overidentifying restrictions:

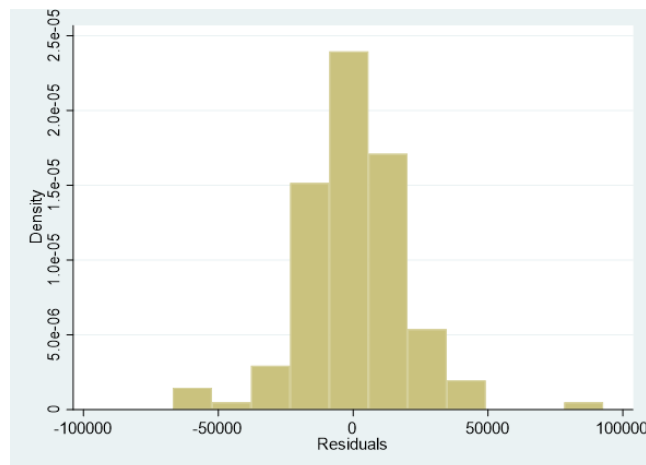
Sargan (score) $\chi^2(2) = 2.35872$ ($p = 0.3075$)

Basman $\chi^2(2) = 1.92248$ ($p = 0.3824$)

In testing for heteroskedasticity, it was important to adjust the conventional testing techniques since a 2SLS model was deployed. Therefore, the traditional White test could not be conducted. Instead, the model's residuals squared were regressed against all exogenous variables in the model, including the instruments, to test for joint significance. This regression showed that the exogenous variables were not statistically significant predictors of the residuals squared (regression table presented in **APPENDIX B**). As a result, the model need not be corrected for heteroskedasticity.

Due to potential data collection limitations, such as the lack of control for regionality, short time span, and limited sample size, the model, when tested for non-normality of the error term, failed the Jarque-Bera test, registering a JB test statistic of $81.3 > 5.99$ (Chi-Squared critical value at the 5% level with 2 degrees of freedom). To address this, the Asymptotic Sample Theory was appealed to, wherein the existence of a relatively large sample size causes the key tests for statistical significance to be asymptotically valid, based on the Central Limit Theorem. Furthermore, the distribution of the error term was found to be closer to a normal distribution when a natural log transformation, an example of a Box-Cox transformation, was applied on the variable for housing supply, $HomeInventory_t$.

FIGURE I: *Histogram of Residuals*



5. 2. Conclusions

To summarize, the regression model, in line with prior findings from Banti and Phylaktis (2021) and Lambi-Hanson et al. (2019), provides empirical support for the hypothesis that, after controlling for other predictors that influence housing prices, the increased presence of institutional investors operating through REITs in the residential properties market is associated with an increase in the real prices of single-family homes.

While the marginal impact of REITs is dwarfed by the impact of macroeconomic control variables and supply on home prices, the growth of REITs is shown to be a contributor in the rising prevalence of home unaffordability in the United States. Not dissimilar to other asset classes, the market for homes also shows a propensity to be pushed upwards when financial instruments, that provide access to institutional investors, are introduced.

The findings do come with limitations, mostly relating to data constraints and certain assumptions made in the model. The data, while from reputable and official sources, is limited in the timespan that it covers as it spans only from 2012 to 2023, overlooking the important sub-prime mortgage crisis of 2007-2010, which could have provided insights into how this relationship evolves in recessionary or deflationary environments.

This constraint, and a handful of others around model specification, can be addressed by using an alternative proxy for REIT performance, as the first observation for the current proxy was reported in 2012. The alternative variable of interest could track the profitability of equity residential REITs or, better yet, the

portfolio size and composition of equity residential REITs, two strong measures of REIT performance that I was unable to find data for.

Additionally, the model only does a nationwide analysis of the relationship, and does not provide any information on how it varies based on regionality. Using a state-level panel dataset could address this shortcoming. However, it is important to mention that a regional analysis of the same relationship would need to incorporate taxation and regulatory considerations, recalling the return-maximizing investing strategies that REITs, and institutional investors in general, adhere to.

Overall, this study provides good direction for future research and inquiry. The impact of institutional investing, through investment vehicles such as REITs, on home affordability warrants further research, especially as the digitalization of investing raises the ceiling on, and therefore the impact of, institutional investing.

6. References

- Banti, C., & Phylaktis, K. (2021). *Financialization of Housing Markets: Can REITs be the Culprit of Rising House Prices?* Available at SSRN: <https://ssrn.com/abstract=3975366> or <http://dx.doi.org/10.2139/ssrn.3975366>
- Basak, S., & Pavlova, A. (2016). *A Model of Financialization of Commodities*. *Journal of Finance*, 71 (4). pp. 1511-1556.
- Cannon, S.E., & Cole, R. A. (2008). *Changes in REIT Liquidity 1988 - 2007: Evidence from Daily Data*. Munich Personal RePEc Archive.
- Capellan, R. U., Ollero, J. S., & Pozo, A. G. (2020). *The Influence of the Real Estate Investment Trust in the Real Estate Sector on the Costa del Sol*. *European Research on Management and Business Economics*, 27.
- Clayton, J., Miller, N., & Peng, L. (2010). *Price-volume Correlation in the Housing Market: Causality and Co-movements*. *The Journal of Real Estate Finance and Economics*, 40 (1), pp. 14-40.
- Federal Reserve Economic Data. *Average 30-Year Fixed Rate Mortgage Rates*. Retrieved from <https://fred.stlouisfed.org/series/MORTGAGE30US>.
- Federal Reserve Economic Data. *Per Capita Real Disposable Personal Income*. Retrieved from <https://fred.stlouisfed.org/series/A229RX0>.
- Federal Reserve Economic Data. *Population Level*. Retrieved from <https://fred.stlouisfed.org/series/CNP16OV>.

Federal Reserve Economic Data. *Producer Price Index: Net Inputs to Residential Construction*. Retrieved from <https://fred.stlouisfed.org/series/WPUIP2311001#0>.

Federal Reserve Economic Data. *Sticky Price Consumer Price Index*. Retrieved from <https://fred.stlouisfed.org/series/CORESTICKM159SFRBATL>.

Fields, D.J., & Uffer, S. (2014). *The Financialization of Rental Housing: A Comparative Analysis of New York City and Berlin*. The University of Sheffield Urban Studies.

Fingleton, B. (2008). *Housing Supply, Housing Demand, and Affordability*. Urban Studies, 45(8), pp. 1545-1563.

Keys, B. J., & Gorback, C. S. (2020). *Global Capital and Local Assets: House Prices, Quantities, and Elasticities*. National Bureau of Economic Research.

Lambie-Hanson, L., Li, W., & Slonkosky, M. (2019). *Leaving Households Behind: Institutional Investors and the U.S. Housing Recovery*. Federal Reserve Bank of Philadelphia.

LBM Journal (2023). *Home Prices Are Rising 2x Faster Than Income*. Retrieved from <https://lbmjournal.com/home-prices-are-rising-2x-faster-than-income/#:~:text=Home%20Prices%20vs.&text=House%20prices%20have%20increased%20x,than%20today's%20price%20of%20%24433%2C100>.

Murphy, A. (2018). *A Dynamic Model of Housing Supply*. American Economic Journal: Economic Policy, 10 (4), pp. 243-67.

National Association of Real Estate Investment Trusts. *FTSE NAREIT Equity & Residential REIT Index (FT17)*. Retrieved from <https://finance.yahoo.com/quote/%5EFN17/history>.

Nishigaki, H. (2007). *An Analysis of the Relationship between U.S. REIT Returns*. Economics Bulletin, 13 (1), pp. 1-7.

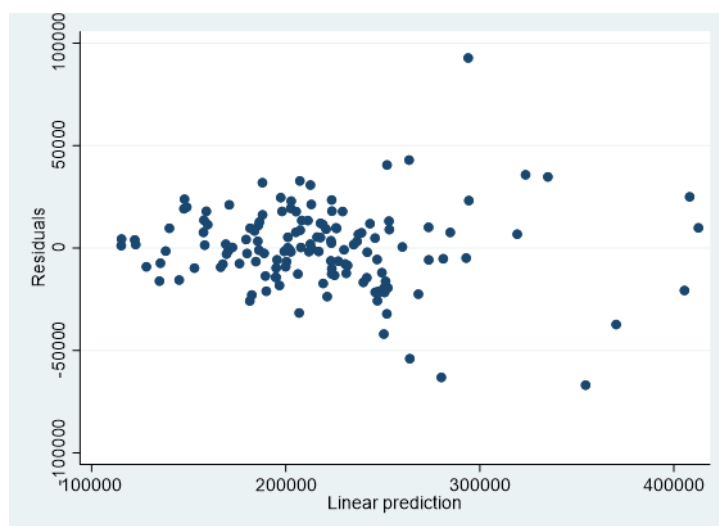
Schaeffer, K. (2022). *A Growing Share of Americans say Affordable Housing is a Major Problem Where They Live*. Pew Research Center.

Trading Economics. *Single-Family Home Prices*. Retrieved from <https://tradingeconomics.com/united-states/single-family-home-prices>.

Trading Economics. *Total Housing Inventory*. Retrieved from at <https://tradingeconomics.com/united-states/total-housing-inventory>.

7. Appendices

APPENDIX A: Plot of Residuals against Fitted Values



APPENDIX B: OLS Estimation - Testing for Heteroskedasticity

resxsq	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
REITIndex	1369557.7	1531434.9	0.89	.373	-1659149.3	4398264.8	
RealDisposableIncome	126652.35	51396.229	2.46	.015	25006.42	228298.27	**
MortgageRates	-1.101e+08	1.408e+08	-0.78	.436	-3.886e+08	1.683e+08	
ConstructionIndex	8214584.6	8686848.5	0.95	.346	-8965328.7	25394498	
PopulationLevel	-57075.266	29821.684	-1.91	.058	-116053.38	1902.848	*
Constant	8.220e+09	5.462e+09	1.50	.135	-2.582e+09	1.902e+10	
Mean dependent var	392480069.951		SD dependent var		940373720.818		
R-squared	0.163		Number of obs		141		
F-test	5.270		Prob > F		0.000		
Akaike crit. (AIC)	6212.623		Bayesian crit. (BIC)		6230.316		

*** $p < .01$, ** $p < .05$, * $p < .1$