Does Single-Family Home Price Appreciation Determine Rent Appreciation?

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Abstract

It is widely perceived that the rent payment on a single-family detached rental property is governed by the rules of the rent contract. Each contract is negotiated when the tenant moves into the property. If the tenant signs a one-year lease, then the tenant is guaranteed to be required to pay only the agreed upon amount for 12 months. But the reality is not simple. Not all tenants of single-family properties sign leases, and a lease agreement might be negotiable. Landlords recognize that constant rents amid higher home prices mean that their rate of return on that property is declining. Thus, higher home prices today, might be followed almost immediately by higher rents as landlords try to shore up earning. Tenants on the other hand, because leaving is difficult, often need time to adjust to this new disequilibrium. It can take time to find a suitable new dwelling. For those tenants that do have a lease, as each individual tenant's lease expires, the tenant can then exercise his option to move. At that point, both the tenant and the landlord reconsider recent home price changes and the relative monthly costs of renting-versus-owning (RVB). Home prices therefore drive rents with both a short-term response and a longer-term, lagged response.

Key words: Central banks and their policies, housing demand, rental demand, rent appreciation

Economic Literature Codes: E58, R23 and R21

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1. Introduction

In Mar-20, the Federal Reserve began a series of purchases of U.S Treasury securities and mortgage-backed securities (MBS) to stimulate the economy in the wake of an unprecedented health emergency which we now call Covid-19. This followed a series of interest rate cuts starting in 2019 which took the Fed Funds rate from 2.50 percent in Dec-18 to essentially 0.0 percent by Apr-20. Over this full period, the 30-year FRM mortgage rate fell by 2.0 percent from 4.87 percent in Nov-18 to 2.87 percent by Jul-21. The assumed goal was to stimulate demand by lowering borrowing costs to consumers. These actions, and infusions of cash to households by the U.S. Treasury successful kept the economy from entering a prolonged recession. The impact of such dramatic action, not surprisingly, was felt in every corner of the economy, and the demand for shelter was no exception. Two years of rapidly declining mortgage rates, and a desire for more space to prevent infection, have additional room to work and play, couple with the aging and the maturing of millennials led many renters to purchase a home and some apartment dwellers to terminate their rental lease and move during 2020 and 2021. Each city was different but home price appreciation (HPA) during those months was very rapid and the Case Shiller 20 City Index ending in Nov-21 was 18.8 percent. This action by the Federal Reserve was a boon to anyone already owning a home, but not every household in America owns a home.[1] Then starting in Mar-22 the Federal Reserve reversed itself and, over the next 19 months, raised its benchmark rate 11 times in an effort to cool inflation. By Sept-23, this puts the federal funds target rate range between 5.25 percent and 5.50 percent and the 30-year FRM mortgage rate at about 7.25 percent.

Renting a home is a substitute for owning a home. Many low- to moderate-income Americans rent single family detached houses (SFR) or apartments in multi-unit structures. In the absence of significant changes in headship rates, the increased demand to live in a home in 2020 and 2021, and the resulting lower demand for rental properties might have slowed rent appreciation.

Rents and rent changes can be measured in two ways. 1) Rents can be measured as contract rents – the median or average of all renter contract rates in a market (recently leased and continually leased). And 2) rent can be measured as a spot rate – the median or average rents of only newly leased units in the current period. Rent changes for this second method generally use a repeat sales index method which matches a property's rent when the lease was terminated to a previous lease change for the same property.

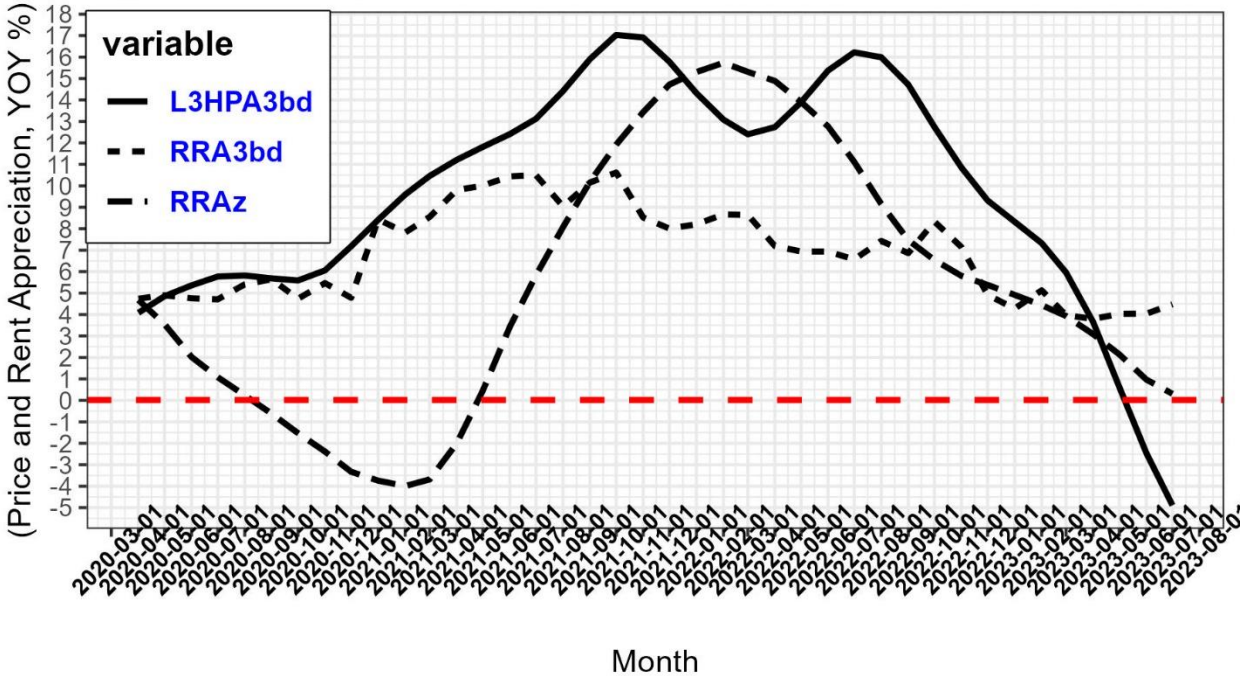
[1] The 2022Q4 Census data shows that 65.8 percent of households own their home.

Chart 1 show year-over-year rent apprecation for Seattle, WA for the period preceeding the outbreak of Covid-19 and some subsequent months afterwards from two data venders. One is for only single-family detached properties from Altisource.com. It does not include rents from condos owned in duplex structures (1 to 4s) nor rents for apartments. It is the median contract rate for only SFR properties with three bedrooms (short dotted line in Chart 1 or RRA3bd). The second source is from Zillow.com (dotted line RRAz). The Zillow rent values are based off samples of mainly higher-tier detached rental units that advertise in the Multiple Listing Service (MLS). It include rents from single family properties but also includes rents from apartments in multi-unit structures. The exact mix of SFR properties to apartments is not stated. The Zillow.com rent estimates are spot rates derived using a neural network based upon two repeat transactions. Both methods have their strengths and drawbacks, and provide a different perspective on renter behavior.

Chart 1 also includes the year-over-year home price appreciation for three-bedroom homes in Seattle, WA lagged three months (L3HPA3bd). The chart shows that rents changes for single family properties initially followed home price appreciation (L3HPA3bd) reasonbly closely, while the spot rate for rents of apartment dropped dramtically, went negative, and then rebounded.

Chart 1. Two Measures of Rent Appreciation for Seattle, WA

High HPA show up in RRA3bd and RRAz



Sources: Zillow.com, Altisource.com, CHTR

There are three reasons why we might have expected RRAz to be more volatile than RRA3bd:

1. RRAz is based upon repeat-transaction leases, it captures a spot rate not a contract rate. In each month there are the new leases signed and the spot rate is recorded, and the contract rates of all other loans are static and ignored.

2. Landlord in multi-unit building have more knowledge. Verbrugge and Gallin (2017) review such differences in their theory of sticky rents. "upon the expiration of the initial rental contract, when the contract is potentially renegotiated, there is asymmetric information: a landlord does not know the tenant's valuation of the unit, or whether the tenant has located another suitable unit. When a contract is about to expire, a landlord must balance the benefit of higher nominal rent revenue against the possibility that the tenant will be provoked to move. All landlords dislike leaving units vacant, but vacancies are more costly for the numerous landlords who own relatively few units." Verbrugge and Gallin make the assumption that landlords are of two types: "small" landlords, who own a single unit, and "large" landlords, who own an infinite number of units. With an appeal to the Law of Large Numbers, they assume that a large landlord knows with certainty the per-unit (average) return for any given offer or renegotiated rent, while a small landlord, whose unit is either vacant or not, faces a potentially large standard deviation of returns.

Tenants in their model dislike moving, but may find the present unit a poor match. For example, they may have found the unit at the last minute, or may have obnoxious neighbors, or may now understand that the unit does not meet their needs. Toward the end of the initial contract period, tenants may engage in costless passive search or costly active search to find another unit, but their incentive to search will be reduced if they expect an attractive rent offer from the landlord.

In this view, large landlords (the landlords for multi-unit structures, or RRAz) always play tough and enter the risky renegotiation process. They are usually able to extract a higher rent from tenants who decide not to move, but sometimes experience lost rent revenue on the unit. On the other hand, small landlords (the mom and pops who own one or two properties, i.e., RRA3bd) play it safe and always offer the tenant the same contract in order to pre-empt active search, and this strategy is usually successful. This is thus a second reason why we would expect RRA3bd to be less volatile than RRAz.

But this lack of ability of mom and pop landlords of SFR properties to manipulate rent also depends on the financial strength of the tenants. Each city is different. Some cities have more properties to rent. Thus, even for tenants with a lease, the inability of landlords to quickly raise rents cannot be taken as a given.

3. Although renters generally sign a lease when they rent a house or an apartment, not every tenant signs a lease. Data from the U.S. Census Bureau's Property Owners and Managers Survey in 1995 (single-family and multifamily units) showed that 44.4 percent of all units had annual leases, 4.0 percent had leases longer than one year, 36.1 percent had leases less than one year, and 15.5 percent had no leases. The correlation between HPA3bd RRA3bd and RRAz for Seattle, WA for all time periods since Jan-13 were 0.30 and 0.37, respectively, indicating that apartment landlords for multi-unit buildings might have more ability to quickly raise rents.

Chart 1 shows that rents changes in Seattle, WA for single family properties initially followed home price appreciation reasonbly closely, i.e., RRA3bd moved with HPA3bd. A positive relationship between HPA3bd and RRA3bd is counterintuitive since lower mortage rates which lowered the cost of owning a home in 2020 and 2021 which in turn raised demand for homes should have lower the demand for rental properties. It could be that landlords of SFR detached properties in Seattle, WA, because many tenants do not have leases, or perhaps because landords can break leases when they see home prices going up, negotiated rents upwards (despite a decline in demand for rental properties). This quick adjustment to rising home prices might have allowed them to recoup their required rate of return on investment properties. Tenants also have some power, If initially, the cost of buying a home goes down because of decline in mortgage rates, some renters of SFR properties might like to substitute out of renting into homeowning. They break their rent contract, suffer a penalty, and buy home. Here, again counter intuititively, reduced demand is accompanied by higher rents as the landlord is free to charge a new rent payment for the newly emptied property. Results in this report, show that changes in HPA3bd positively and significantly impacted RRA3bd, in six out of my twenty cities.[2]

Chart 1 also indicates something else: The long-term reponse by renters of single family property tends to undershoot the quicker response measured by spot rate of renters of apartments in multi-unit building. Not all renters can afford to break their contract and buy. The remaining renters need to wait until their contract expires before they can adjust to the new equilibrium.

In thinking about home prices and rents, one must go back to Poterba (1984) who develops the home buying/rent decision in terms of a user cost of capital. The cost of owning a home is the price times the user cost of capital (UCK) and is normally written as

$$P * UCK = P * ([k + \tau_p + m - E(\pi)] - [(k + \tau_p) * T_f]) \quad (1)$$

[2] Cities, here, are measured as Core Business Statistical Area, or CBSAs.

Where P is the home price; k is the mortgage rate; τ_p is the property tax rate, a tax payment relative to house price; m is the maintenance cost, $E(\pi)$ is the expected home price appreciation and T_f is the federal tax rate. Poterba argues that in equilibrium, the entire cost of owing (buying) must equal the cost of renting an identical house. Or, for every city, markets adjust until the cost of renting equals the cost of owning for a month.

$$R_{it} = UCK_{it} * P_{it}, \text{ or } R_{it} = B_{it}, \quad (2)$$

This introduces the idea that tenants of three-bedroom properties if they can afford to buy a home are looking at the relative cost (RVB, where $RVB_{it} = R_{it} / B_{it}$) in the duration of time before their lease expires. If this is true, then asking the question what drives rent appreciation must include how does HPA intitially impact RRA and then again how does HPA impact RRA over time?[3]

Equation 2 implies that HPA will impact RRA once tenants of SFR properties with expiring leases exercise their ability to move. In 2021 and 2022, the decline in mortage rates drove the monthly cost of owning down. This raised demand to purchase, generating higher homes sales and higher home prices. However, as home prices rose, with rents static for most tenants, the cost of renting versus the cost of owning began to fall. At some point, the change in relative cost of renting vis-a-vis buying causes the demand for SFR rental properties to rise. As many 1-year leases ran out, rental rate for properties began to accelerate. Thus as time moves forward, the lower RVB from earlier period, concurrent with leases expiring, raises demand for rental properties. And, this causes RRA to increase – a 2nd order impact.

This second-order impact of HPA on RRA is displayed in Chart 2 for Seattle, WA. The horizontal axis measures RVB for three bedroom properties from 12 periods earlier. As we go from right to left, renting-versus-owning 12 months earlier (L12RVB) gets smaller due to the cost of owning (B) rising and RRA slows. The first-order impact of faster HPA causing RRA to accelerate (tough landlords raising rents despite a substitution away from renting) is, at some point, over-whelmed by the second order impact of the near-impossibility of substitution to buying for most renters (or new households) which drives RRA higher.[4]

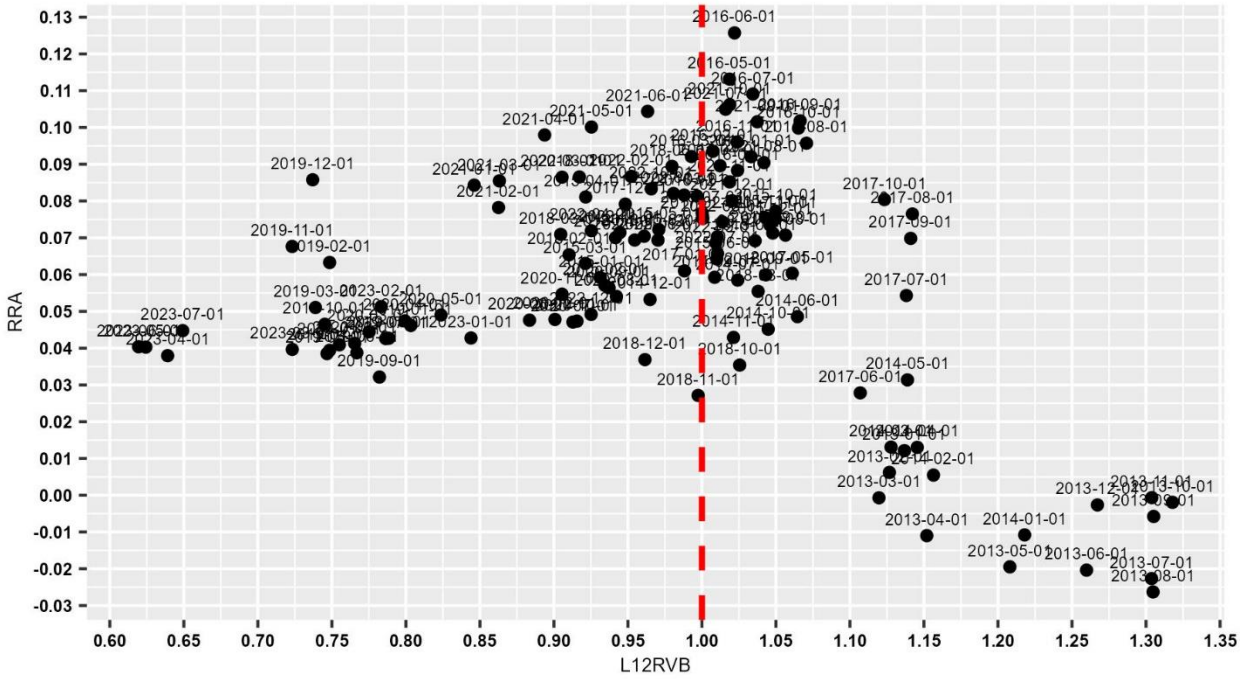
By Jul-23, any initial relative cost advantage to buying had disappeared. Renters who were potential homebuyers faced a higher P, a higher UCK which raised the cost of buying (B) and lowered the demominator of RVB. Since RVB continued to fall, the pressure on the

[3] At this point, I change my notation. Since I am only dealing with three-bedroom SFR properties, RRA now refers to the year-over-changes in SFR rents of three-bedroom properties. The notation RRA3bd and RRAz will be dropped.
[4] It could be that this dynamics increases homelessness.

rental market demand has increased. The latest observation on that chart is 2023-07-01, a point in time when renting is much cheaper than owning in Seattle, WA.

Chart 2: Seattle, WA: 3 Bdr Properties, RRA & L12RVB

If RVB>1, RRA slows because renting is more expensive than owning



Sources: Zillow.com, Altisource.com, CHTR, Jan-13 to Jul-23

This paper demonstrates that home price inflation (HPA) drives rental market inflation (RRA) through two distinct intertemporal forces: There is a short-run response (a form of serial correlation) of home prices and rents on rents. In strong housing markets, landlords have an ability to raise rents concurrently with home prices increases because they recognize that their tenants have the financial means to absorb rent increases, and they do. Thus, in these CBSAs, rent appreciation (RRA) for 3-bedroom SFR properties is strongly positively tied to near-term HPA changes in 3-bedroom properties. We see this in six of my twenty CBSAs. Second, there is a longer-run response based upon the relative cost of owning-versus-buying (i.e., relative prices). After 12 months, the point in time at which rental contracts for SFR properties terminate, renter and landlords adjust to relative costs of the preceding year. Rent appreciation quickens. We see this in fourteen of my twenty CBSAs.

My contribution to the literature is to show rents are driven by home prices not vacancy rates. Thus, HPA drives RRA in the short-term and in the longer-term. However, the speed of rents adjustment to serial correlation and relative prices (RVB) is also impacted by vacancy rates, employment changes, credit scores, the thickness or depth of the rental market (how many properties in the CBSA are rental properties) and other CBSA specific

confounders. I explore these relationships in 20 individual CBSAs to eliminate the problems of fixed-effect confounder in each CBSA. All of the rent data used in this paper are median contract rates for three-bedroom single family properties, so this paper is a not a test of the sticky rent theory.

Section 2 initially reviews the previous research on interest rate changes and home price appreciation. It then extends this research onto the rental market for three-bedroom single family detached properties. In that section, I lay out the methodology for estimating the impact of HPA on RRA. Section 3 explains the data. The results and interpretations are in Section 4. My conclusions are in the last section.

2. Background, previous research, and model

2.a Justification

The Harvard Joint Center for Housing and the Census department reports that there about 47.4 million non-owner-occupied units (rental units) in the United States. One single family detached property (SFR) counts as one unit. This stock of 47.4 million units includes 15.3 million detached SFR homes and 8.2 million duplex units in SFR homes (also called attached SFR).[5] Thus, the SFR property rental market is large.

Whereas the SFR purchase market has been extensively modelled, the SFR rental market has not. The data did not exist to do research. Sometime in the late 2000s, three data providers started providing city level data on rents charged by owners of single-family rental properties.[6] I now explore three approaches to modelling rental market dynamics:

2.b Modelling rent: asset pricing theory and the fundamentals approach

Initially researchers modelled home price appreciation as being driven by expectations of future rent appreciation and that expect rent appreciation is driven by fundamentals. Blackley and Follain (1995) use a four-equation model to model rent determination for the nation. The four sectors are demand per household, the number of renters per household, the supply of rental housing and a rent adjustment equation. It is a four-equation simultaneous model approach using two-stage least squares. It is not an error correction model. Their paper is the first to investigate how fast the rental market responds to changes in the user cost of capital. They find that a 10 percent increase in the user cost of capital raises rents by 1 percent after five years. More recently, Saunders and Tulip (2019) use a single equation model specifying changes in rent as a function of lagged changes in rent

[5] Harvard Joint Center on Housing (2022). Note some rental units are in trailers.
[6] Zillow.com, CoreLogic and Altisource.com.

(recognizing that rents suffer from serial correlation), vacancy rates and income. They do not include the variable HPA as a right-hand-side variable.

2.c Modelling rent: VECM, the fundamentals approach

Many house price researchers argue that the city-level house price adjustment process is best described by a two-stage model in which house prices grow with income, population, employment, and other economic and non-economic variables (zoning restrictions, weather, migration). In stage one, we can think of all of these fundaments in a single variable $\mathbf{X}_t$. These variables are the fundamentals economic forces driving growth. House price growth also exhibits momentum and mean reversion. The mean reversion in the short-run is a response to the disequilibrium force of the difference between the actual market price (P_t) and the fundamental or equilibrium price (P_t*) which is determined by all of the market forces (or, $P_t^* = f(\mathbf{X}_t)$). The fundamentals approach thus involves two stages of modelling: The first stage involves estimation the long run relationships of P_t* to the fundamentals and then the derivation of the error term ($P_t^* - P_t$) which is used in the second stage as the error correcting force (ECT). The ECT brings about reversion of P_t over time towards P_t*. The second stage is a measure of short-run behavior. This approach has not been favored for modelling the rental market.

2.d Modelling rent: VECM, the rental approach

Other researchers have taken a different approach to modelling home prices which they also applied to rents. As noted above, Poterba (1984) develops the home buying/rent decision in terms of a user cost of capital. He argues that in equilibrium, the entire cost of owing (buying) must equal the cost of renting an identical house. Or, for every city, markets adjust until $R_{it} = B_{it}$ (Equation 2), where $B_{it} = UCK_{it}* P_{it}$.

Everyday experience indicates that housing and rental markets at time t do seem to function in the classical economic framework of perfect competition as Poterba suggests. Marginal buyers and sellers have access to an exceptionally large information set, and can substitute (at the time immediately before the transaction) without costs between renting and buying. A potential buyer of a home faces the choice outlined by Equation 2, (the rent/buy decision). If we think of each CBSAs as being a collection of economic agents, home prices should adjust upward under higher demand until the R_{it}/B_{it} approximates 1.0. For every city, markets are always adjusting towards $R_{it}/B_{it} = 1$. This relationship between B and R introduces an error correction term of RVB into the short-run market framework which is the basis for a VECM model.

Moreover, following Poterba (1984), it is reasonable to think that most of the economic forces that move house prices move rents. The actions of the would-be homebuyer at the time of purchase (time t) reflect the would-be homebuyer's consideration of his income,

employment position, how the city is expanding around him, etc. Since this is the case, rent captures the influence of the fundamentals. It is not necessary to model all of the fundamental economic variables. One can then construct a long-run model of rents determination, as

$$\ln R_t = \alpha + \gamma_1 \ln B_{t-k} + \xi_t \quad (3)$$

This is Equation 2 specified in logs, where k is some lagged time period. This would represent the first stage in the VECM modeling process. We can then use $\ln RVB_{t-k}$ or ξ_t as our error correction term in stage two. To use either RVB_{t-k}, or ξ_t the relationship between R_t and B_t should be stationary. The second stage models is thus,

$$\Delta \ln R_t = \alpha + \beta \ln RVB_{t-k} + e_t \quad (4)$$

Here, the sole determinant of rent appreciation in time t is the lnRVB ratio from t-k. Under this approach, a long-run function is not needed and is not estimated. The variable $\ln RVB_{t-k}$ acts as the error correction term. It is an internal force which changes the market. When RVB goes out of balance, the marketplace adjusts (i.e., R and P adjust) and ΔR and ΔP move RVB back towards a stationary mark (mean reversion to a value of 1.0).

Verbrugge (2008) uses a VECM approach on sample data from 1988 to 2003 to model the effect of RVP and UCK (rather than RVB) on RRA. He constructs a rent index using a post-1987 CPI rent microdata set comprised of rent of only single-family detached dwellings. Using a VECM model on the nation, four regions and 10 individual CBSAs, he finds "rents generally do not appear to react to quarterly changes in the user cost of capital, not even with a lag." He does point out that RRA responds to HPA. Home price inflation is partially responsible for rent inflation. Verbrugge (2008) does include the vacancy rate for each geography.

Gallin (2008) uses national data of the tenant rent index from the Consumer Price Index. The data is quarterly from 1970: Q1 to 2005: Q4. The problem with the CPI survey data is that it is survey data and includes observations data from multifamily structures. Using a lag of four quarters and a VECM model, he finds that 100 bps decline in the UCK would lower RRA by 40 bps after 4 quarters. Ambrose, Eichholtz and Lindenthal (2013) follow Gallin's approach to examines the long run relation between prices and rents for houses in Amsterdam from 1650 through 2005. Fout, Haidorfer and LaCour-Little (2017) using data from 2009-2015 on fifty CBSAs find that prices and rents are, in general, co-integrated and that home prices and rents respond to RVB with a 12-month time lag in ways consistent with economic theory.

2.e Modelling rent, modifications, and full model

Conceptually all information about fundamentals is contained in both B and R (they should be equal, or heading towards each other). To model rent appreciation, I modify Equation 4, by first including a lagged dependent variable and its counterpart to account for inertia in HPA and RRA. Next, I include the lnRVB lagged 12 months. The time lag was suspected to be 12 months assuming that most tenants of SFR properties have one-year leases.

I re-write Equation 4 as,

$$\Delta \ln R_{it} = \alpha + \beta_1 \Delta \ln P_{it-3} + \beta_2 \Delta \ln R_{it-3} + \beta_3 RVB_{it-12} + \beta_4 \mathbf{Z}_{it} + e_{it} \quad (5)$$

where $RRA_{it} = \Delta \ln R_{it.}$

I am trying to account for 1) the auto-regressive nature of home prices and rents, and 2) the simultaneous delayed impact of HPA on RRA through mean reversion of RVB twelve months after any house prices changes have occurred.

In order for the models to be stable: $-1 < \beta_2 < 1$, $-1 < = \beta_3 < 0$. The auto-regressive nature of HPA and RRA must take a smaller signal from the prior month; rent appreciation should respond negatively to high RVB.

The variable $\mathbf{Z}_{it}$ contains the vacancy rate from 12 months prior, the share of homes that are rental properties (non-owner occupied), the year-over-year change in the employment rate and a dummy variable for a period of time when mortgage rates fell during Covid-19 pandemic. I run Equation 5 twenty times, once for each CBSA. By using percent change, I am tracking behavior over time for each CBSA. In essence, I am comparing each city to itself. This reduces the number of unidentified fixed-effect cofounders.

3. Data

3.a Rent

The unit of analysis is the core based statistical area. Altisource Residential Corporation tracks single family housing rents at the CBSA level. The Altisource data starts in 2009. Altisource gathers asking and actual rents from a large sample of property managers of single-family properties. Rents from units in multifamily properties are not included in the sample. They provide the median rent for five different bedroom counts on a monthly

basis.[7] The data is neither seasonally adjusted, nor adjusted for quality. It also does not include the cost of utilities. Fout, Haidorfer and LaCour-Little (2017) have verified that the Altisource 3-bedroom SFR data track the owner's equivalent rent and the tenants rent from Census.

3.b Prices

The price data for 3-bedroom houses comes from Zillow.com. The price data reflects the typical value for homes in the 35th to 65th percentile range. The values are then smoothed, and seasonally adjusted. The values of home prices are based on changes derived from a neural network methodology similar to a repeat sales transaction values built up from Zillow's housing prices model.

3.c User cost of capital

The user cost of capital is defined in Equation 1. The interest rate k is the Freddie Mac 30-year survey rate plus points; property tax rates are derived as average property taxes paid in each CBSA reported in the IRS report of income divided by the Zillow.com median home price (see immediately below). T_f is the federal tax rate by income class. The variable m in the user cost of capital equation is 3.5 percent of the property value for three-bedroom properties. A final issue to address is expected house price growth $E(\pi)$, which I do not attempt to measure. Several earlier authors attempt to measure $E(\pi)$ with backward looking estimation such as $E(\pi) = (P_t - P_{t-1})/ P_{t-1.}$ There are two major problems with using past home price growth: 1) it misses turning points and 2) it misleadingly lowers the user cost of all CBSAs since all recent history shows strong positive home price growth and strong future HPA is not a given.

3.d Property and federal income tax rates

Property tax rates are calculated for each CBSA for each month. The IRS reports the average property tax amount paid each year for each income cohort. I divide the IRS data on average yearly property taxes paid by the median price of the home each month to get a property tax rate (PTR) each month.[8] Since the property prices are reported monthly, the calculated property tax rate has a monthly periodicity. The federal income tax rate for each CBSAs is based on the combined IRS reported amounts of federal income tax receipts for all households in a CBSA with adjusted gross income between $75k to $100k divided by the number of reported households in that bracket. The result is a federal income tax rate with an annual periodicity. Source: IRS Report of Income.

[7] Altisource purchases its rental data from investors, property managers and other proprietary data sources. In addition, they use MLS data where possible. On a weekly or bi-weekly schedule, their data providers provide them with both asking and actual rents. As a result, they have current asking and actual rents at the CBSA level. Altisource estimates that they have around 15% to 30% coverage of the rental properties outstanding in each of the CBSAs.

[8] The IRS data is only for those who itemize. Tax data on those taking the standard deduction are thus not included.

3.e Vacancy rate
Vacancy rate for all properties. Source: Census, Periodicity: quarterly.

3.f Employment
Monthly employment numbers are year-over-year changes in counts of all employees, Source: BLS, Periodicity: monthly.

3.g Landlord share of existing homes: The landlord share is ($Llord_i = 1 - HOR_i$), where HOR_i is the homeownership rates, a ratio of the housing stock. The denominator includes the total number of units (rented and owned) in $CBSA_i$. Thus, the denominator includes apartment units rented, single family detached units (properties) rented, and properties owned and occupied. The numerators are just units owned. Source: Census, Periodicity: quarterly.

Summary data are in Table 2 in the appendix.

4. Results

4.a Model results, first-order effect of HPA
Table 1 shows the relationship for only two of the six independent variables (L3HPA and L12RVB) on the dependent variable RRA.

Rents exhibit a high degree of positive momentum with home prices in six out of my twenty cases. In these CBSAs, the β_1 coefficient on L3HPA is significant and positive, i.e., higher home price appreciation means high rent appreciation three months later. It appears that in these six CBSAs, landlords have a significant ability to raise rents in relationship to home prices rising. These are large CBSAs with high average credit scores. In only two CBSAs, the β_1 was negative and significant (Boston, MA, and Chicago, IL). In these two CBSAs, as home prices accelerate rent appreciation slows three months later.

4.b Model results, the second-order effect of HPA
Changes in home prices also filter into RRA twelve months later through the L12RVB variable. The sign on the β_3 coefficient has to be negative to be logically correct – when it is more expensive to rent than to buy in prior periods, rents demand falls and RRA slows. The coefficient β_3 for this variable (Table 1 column 4) is negative and significant for 14 out of my 20 CBSAs, i.e., in a period when the cost of buying a home is falling and contract rents are near static, as we saw in 2020 and 2021, a negative β_3 coefficient suggests that the higher RVB in that period would be followed in 12 months by rents slowing.

Table 1. Coefficients on L3HPA and L12RVB							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CBSA	L3HPA	P-value	Significance	L12RVB	P-value	Significance	R-sqr
Albuquerque, NM	0.22	0.00	**	-0.04	0.00	***	0.84
Baltimore, MD	-0.06	0.64		-0.10	0.00	***	0.71
Boston, MA	-0.36	0.00	**	0.07	0.00	***	0.65
Chicago, IL	-0.15	0.01	*	-0.04	0.00	***	0.55
Dallas, TX	0.06	0.38		-0.01	0.41		0.75
Denver, CO	0.06	0.47		-0.03	0.04	*	0.74
Houston, TX	0.09	0.10		0.01	0.34		0.65
Indianapolis, IN	0.14	0.13		-0.02	0.01	*	0.46
Las Vegas, NV	-0.05	0.34		0.00	0.81		0.73
Los Angeles, CA	0.11	0.01	*	-0.07	0.00	***	0.64
Memphis, TN	0.15	0.26		-0.04	0.03	*	0.71
Miami, FL	0.26	0.00	***	-0.02	0.05	'	0.81
Milwaukee, WI	-0.05	0.58		-0.08	0.00	***	0.75
Minneapolis, MN	-0.02	0.81		-0.05	0.00	**	0.70
New York, NY	0.17	0.07	'	0.00	0.82		0.45
Phoenix, AZ	-0.02	0.77		-0.03	0.32		0.69
San Francisco, CA	0.30	0.00	***	-0.11	0.00	***	0.77
Seattle, WA	0.26	0.00	***	-0.06	0.00	***	0.72
Tulsa, OK	0.02	0.81		-0.06	0.00	***	0.74
Washington, DC	-0.12	0.17		-0.03	0.01	*	0.71
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 0.1 ' ' 1							
Data is from Jan-13 to Jul-23.							

Consider now the rent/buy decision when the cost of buying a home has risen (the more-near-term period of 2022 and 2023). The β_4 coefficient measures the response of renters of single-family properties who had a one-year lease contract and only now are able to terminate their lease at the end of 12 months. The renter who did not buy in 2020 or 2021 (a bad thing from their point of view) because both P and UCK in this later period are so high, are even less able to afford to buy a home. They are confronted with a higher absolute rent payment but a lower monthly relative cost of renting versus buying because B has risen so quickly. Each month they make a value decision. The fact that they are absolutely worse off (a higher rent), but relatively better off (a lower RVB) increases the demand for rental properties, and rent appreciation quickens.

The β_3 coefficient measures the speed of adjustment in each CBSA averaged across time. Focusing on the U.S. rental market by Mid-2023, more renters since they could not afford to buy a home in the twelfth month when their lease expires, responded to very low RVB by continuing to rent and RRA does not moderate.

The CBSAs with the fastest speeds of adjustment are Baltimore, MD, San Francisco, CA and Los Angeles, CA. The force of RVB would mean that rents will rise quicker in these CBSAs since RVB in Mid-2023 is so low in these CBSAs and the coefficients are strongly negative values. Only Boston, MA has β_3 that is positive and significant. The very strong labor market might have been the driver.

The short-term-lagged and the long-term-lagged impacts are sometimes complimentary forces impacting RRA and sometime countervailing forces. Focusing on Seattle again, the very right-hand side of Chart 1 shows that in Mid-2023 HPA3bd is negative (prices are falling), but RRA3bd is running around 4.0 percent. In a period of falling home prices, landlords lose an incentive to raise rents. Despite this flattening price, accompanied by a rise of the cost of owning (through higher interest rates in Mid-2023), renters and new households in Seattle respond to relative prices (an RVB greater than 1.0). Falling (but still too expensive home prices in time t) is not enough to influence the decision to rent. This keeps RRA from moderating and likely will do so for a long time even though HPA is falling.

4.c Model results, other variables

It is sometimes questioned whether vacancy rates - the balance of supply and demand - affect the cost of housing. Saunders and Tulip (2019) find strong evidence that vacancy rates drive rent changes. Whereas Verbrugge (2008) and Goodman and Belsky (1996) do not. The vacancy rate was significant and negative (higher vacancies from 12 months earlier slows rent appreciation) in only 4 out of my 20 CBSAs. Thus, the evidence from this research suggests the impact of vacancy rate is not strong. Employment growth and landlord shares also do not play consistent significant roles in rent determination.

5. Conclusions

This paper has focused on the purchase and rental markets of only single-family properties. It contains no information about rents of apartments in multifamily properties. The research is based on a twenty-city panel dataset over the period Jan-13 to Jul-23.

In a period of tight housing supply and low vacancies rates, changes in vacancy rates are not significant drivers of rent changes. Instead, relative prices (RVBs) are the primary driver of subsequent rental growth. The near-immediate first-order effect of higher home prices is a strong positive impact on rents paid by tenants of SFR properties. This shows up in six of my twenty CBSAs. Recognizing that some/most tenants have leases, it is surprising that home prices changes are directly followed by rent changes in these six CBSAs. Landlords are concerned about maintaining a rate of return on their investment

property. It could be that when home prices rise very quickly, landlords adjust rent upwards, when and where they can, in line with HPA. More importantly, there is a later, second-order impact of HPA on RRA which is more applicable in today's market of very expensive home prices. In 14 of my 20 CBSAs, the rental market, depending on the CBSA, continues to adjust, not right away, but in a lagged fashion to the aforementioned rise in HPA. In this second response, higher home prices impact the relative cost of renting versus buying. Quickening or slackening rent appreciation does not immediately occur in response to the changed relative prices. Historically, it takes approximately 12 months. Both tenants and landlords are often locked into one-year contracts, and it takes time for a renter (or new household) who is trying to become an owner to shop for a home to buy.

Buying a home in 2023 is out of reach for most renting households. Unintentionally, the interest rate increases by the Federal Reserve in 2022 and 2023 has made renting relatively cheaper (RVB has fallen), and rent will appreciate at faster rate due to higher demand despite renting become absolutely more expensive (more income must be allocated to renting). Going forward, this will work against CPI owners' equivalent rent slowing down in the second half of 2023 and all of 2024.

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Appendix

Table 2. Mean Summary Statistics					
Jan-13 to Jul-23					
	HPA, YOY %chg	**RRA**, YOY %chg	**RVB**, Ratio	**LLORD**, % %shr	**VAC**, rate
Albuquerque, NM	0.06	0.04	1.19	33.2	5.58
Baltimore, MD	0.04	0.03	1.32	33.0	7.82
Boston, MA	0.07	0.04	1.06	39.2	4.88
Chicago, IL	0.06	0.03	1.27	34.3	7.10
Dallas, TX	0.10	0.05	1.34	39.2	8.01
Denver, CO	0.09	0.06	1.15	38.4	5.11
Houston, TX	0.08	0.04	1.40	38.9	9.26
Indianapolis, IN	0.08	0.04	1.44	33.3	8.70
Las Vegas, NV	0.12	0.05	1.16	44.9	8.49
Los Angeles, CA	0.08	0.05	1.00	51.7	4.94
Memphis, TN	0.08	0.04	1.50	39.4	8.47
Miami, FL	0.10	0.06	1.35	40.8	5.59
Milwaukee, WI	0.06	0.02	1.09	40.5	5.11
Minneapolis, MN	0.07	0.04	1.23	29.1	5.89
New York, NY	0.05	0.04	1.03	49.7	5.07
Phoenix, AZ	0.11	0.07	1.14	35.8	7.17
San Francisco, CA	0.09	0.05	0.81	45.1	4.17
Seattle, WA	0.10	0.06	0.95	40.2	5.26
Tulsa, OK	0.06	0.04	1.35	34.2	7.76
Washington, DC	0.05	0.03	1.13	34.9	4.61

Sources: Altisource.com, Zillow.com, Census, Transunion, Corelogic, IRS, CHTR