Segmentation and Returns on Rental Housing*

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Abstract

This paper studies how rental affordability and landlords' returns on apartment rental housing have changed across the quality distribution. Using a novel combination of property-level data on rents, operating costs, and transaction values, we establish three facts: (1) asking rents increased more at the lower end of the quality distribution since the Great Recession; (2) this outsized rent growth has not been accompanied by higher operating costs – internal rates of return (IRR) also increased more in the lower quality segment; and (3) most new housing has been added in higher-quality segments. We show that these facts are related. The supply response to demand growth during the recovery has skewed towards high-end rental housing, mediating the response of rents and returns for existing high-quality housing. We use a CBSA-level Bartik instrument to show that lower-end rents and returns respond more to demand shocks and find that a third of this differential rent responsiveness is due to the differential responsiveness of new supply across segments.

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1 Introduction

Since the Great Recession, there have been persistent concerns about housing affordability and gentrification. Nominal rents and rents relative to renter incomes have grown.This pattern is especially true for lower-income renters. While a popular narrative blames greedy landlords for the low-end rent growth, it is not clear whether the rent increases accrue to landlords, or are instead compensating them for higher acquisition or operating costs. To the extent that returns to landlords have grown, it is also unclear what has afforded them this market power. Anecdotally, activists often connect the rise in low-income rents to the construction of new 'luxury' apartment buildings crowding out low-end supply, but landlords cite rising cash flow risk from non-payment and/or rent control laws driving up their cost of capital. This paper asks how rents have changed since the Great Recession, whether landlords have captured these gains, and why. We focus especially on differences in these patterns across the quality segments of the multifamily rental market.

Most academic evidence on this topic has used either posted rents or single-family house prices as a proxy for landlords' returns with limited nuance for quality differentiation. We assemble new data to measure changes in landlord returns, rents, and new supply by quality segment. We categorize properties into three quality segments based on where their per unit rental income falls in their city's distribution. These data yield three new facts: low-quality units have seen more growth in rents and landlord returns and less new supply than high-quality units in the recovery from the Great Recession. In theory, these facts are linked. As new supply enters at the top of the quality distribution, it competes most intensively with pre-existing high-end rental units, moderating that market segment's rent and return growth. We present causal evidence of this link: We establish that local demand shocks induce higher rent and return growth for low- than high-quality rental units, but less so after controlling for new supply. The effect of new supply explains a third of the differential responsiveness of low- versus high-quality units to demand shocks.

We first show that, in a panel of every large market-rate apartment building in the 48 largest cities in the U.S., asking rents have risen disproportionately for lower-quality buildings relative to higher-quality buildings between 2005 and 2019. Asking rents grew in all quality segments, but 11 percentage points faster in the lowest quality tercile, where nominal rents grew by 48 percent, than in the top quality tercile, where nominal rents grew 37 percent. This divergence grew the most during the Great Recession and in the late 2010s.

To study landlords' returns, we construct a property-level panel dataset on apartment buildings coming from two main sources. First, we construct a panel of annual net operating incomes from commercial mortgage-backed securities (CMBS) reporting information, obtained from Trepp. The panel construction allows us to measure property-specific returns over landlords' holding periods, which we specify as a mortgage term for each property. Second, we observe transaction values for properties placed in CMBS at both the origination of a mortgage term, and the end of the mortgage term (at prepayment or maturity) from apartment transaction data obtained from Yardi. Using the net income flows and prices at the beginning and end of holding periods, we construct internal rates of return (IRR) at the property-by-holding period level.

With this panel of annual net operating incomes and transaction data, we measure landlords'

returns over time and across the quality distribution. Generally, lower-quality apartments have higher IRRs, partly reflecting the lower cost basis of these buildings at the beginning of their holding period. Further, while IRRs increased on average between 2005 and 2019, they increased the most for lower-quality buildings. The average return for a property in the lowest-quality tercile grew 250 basis points more than the top-quality tercile. In part, the overall rise in IRRs reflects a decline in capitalization rates (an inverse indicator of how much capital markets value cash flows) driven in part by declining interest rates. A decomposition shows, however, that the widening quality gap in returns is driven equally by outsized low-end growth in net operating income combined with outsized growth in how capital markets' valued those cash flows. This result leads us to conclude that there were real economic shocks disproportionately affecting lower-quality buildings relative to higher-quality buildings, not simply a differential impact of national-level cap rate compression on segment-specific IRRs.

The final descriptive fact that we highlight is that most new rental housing enters at the top of the existing rent distribution. Anecdotally, this fact is well-recognized but there is little work quantifying this phenomenon or attempting to understand its causes and consequences. We use American Community Survey (ACS) data from the Census Bureau to study where newly constructed rental units enter the rent distribution over time and across cities. Since the Great Recession, 50 to 60% of new rental units enter the top quartile of the unconditional city rent distribution. This skew is even higher among market-rate buildings: 80% of new market rate units in large cities enter the top quartile of the rent distribution.

A plausible explanation for the outsized rent and return growth at the low end of the market is limited supply growth in response to the sustained long-run demand growth in rental markets experienced between the Great Recession and the COVID pandemic. We test this explanation using local labor market shocks.

We first ask whether rental incomes and returns on lower-quality buildings are more responsive to local labor market shocks than those on higher-quality buildings. We find that NOI from low-quality properties increases by 29 percent more – by 0.9 percent for each percent increase in city-level employment – than NOI from high-quality properties – which grows 0.7 percent for each percent increase in city-level employment. It is possible that this differential responsiveness reflects confounding factors that drive city-level employment growth and also explain differential rent growth. To identify the causal effects of local employment growth, we use a Bartik-style shift-share instrument as a proxy for local employment growth and find that the elasticities are both biased towards zero (coefficients on the Bartik measure are 1.3 pp and 1.15 pp at the low- and high-end respectively) but the differential across the quality distribution persists. The differential is even larger when measuring the responsiveness of IRR to employment growth: Lower-quality property returns are 0.79 pp higher with each 1 percent higher employment growth, while higher-quality property returns are only 0.17 higher. This gap is comparable using Bartik shocks instead of employment growth.

We then estimate how much of the differential rent and return responsiveness is due to the more elastic supply of higher-quality rental housing. Specifically, we study how much of the elasticity differentials estimated above persist when controlling for new construction and the share of new construction in the higher quality segment. We find that new rental housing supply is negatively

associated with rental income growth and returns for existing owners. Controlling for this correlation disproportionately lowers returns for higher-quality properties, but has very little effect on the low-quality segment. These new housing supply variables absorb 70-80% of the differential effects of employment growth on rental income and 40-45% of the differential effects on returns.

As a product of this analysis, we show that city-level new housing supply is negatively correlated with subsequent rental income growth and returns, but primarily (or exclusively, in the case of returns) for higher quality housing. We also show that the share of new housing entering the top of the existing rent distribution is positively related to rental income and returns for lower-quality properties.

Beyond differential supply elasticities, other factors that could explain the outsized returns at the low end of the rental housing market include differential changes in asset markets. Ghent (2021), for example, shows that market liquidity and transaction volume varies across cities in a way that is related to delegated investors (or the market signals dynamics of developers in Büchler, Van de Minne, et al. 2020). It is possible that the higher returns at the low-end of the market result from higher returns demanded in capital markets due to weak growth expectations or greater perceived risk. We find little evidence, however, that the cost of capital can explain a meaningful portion of the differential changes in returns in low- versus high-quality apartment buildings.

This paper presents new evidence on rents and real estate investment returns on commercial real estate. Previous work establishes that commercial rental yields and returns vary across geographic markets (Amaral et al. 2024; Eichholtz et al. 2021; Korevaar 2023; Plazzi et al. 2010) and over time (Peng and Thibodeau 2020; Reher 2021). We document variation in rents and returns across the quality distribution and find that returns are higher on properties with lower-priced units. This finding contrasts with results from related work studying single-family house prices over the same period. Peng and Zhang 2021 found that higher-priced homes appreciated more between 2000 and 2015, while Hartman-Glaser and Mann 2017 showed that returns are higher in high-income areas, where prices also tend to be less volatile.

In closely-related work measuring rent growth across segments, Molloy (2024) finds that lower-income households reported higher rent growth in the American Housing Survey between 1985 and 2021. Halket et al. (2023), meanwhile, find that single-family homes in low-income submarkets had higher yields and returns. Controlling for heterogeneity by looking at rental and price appreciation within property, we find that the low-end of the multifamily market – the focus of the debate over tenant affordability and "landlord greed" – has also seen outsized rental growth and returns since the Great Recession.

The differential elasticity of rental income at the low vs. the high end of the market is consistent with novel results from Watson and Ziv (2024) who show market power in the multifamily rental market. Our results suggest that this market power derives from limited new supply of lower-quality rental units, consistent with Watson and Ziv (2021)'s evidence that zoning constraints generate market power and increase rents. Most research on the effect of new supply on rents studies the effect of a new building on surrounding asking rents (e.g., Asquith et al. (2023), Li (2022), and Pennington (2021)). Using data on city-level rents and prices, Büchler, Ehrlich, et al. (2021) argue for a cap rate amplification channel for housing supply—If an increase in rental income subsequently

increases prices by more than one-for-one, rent increases will result in more housing supply than a similar-sized increase in prices alone. Our paper is the first to show how new supply relates to rental income as well as returns.

Finally, we provide novel evidence consistent with some of the evidence on quality segmentation using assignment models in the housing market (Anenberg and Kung 2020; Landvoigt et al. 2015; Nathanson 2023). We present new evidence on rental market segmentation consistent with endogeneity in the quality-segment-specific supply-side response, consistent with the assignment model with endogenous supply in the owner-occupied housing market in Wang (2023).

2 Data

This paper relies on property-level financial data for multifamily rental properties collected by servicers on mortgages placed in commercial mortgage-backed securities and maintained by Trepp. The financial data are collected quarterly by servicers, though most borrowers only report updates to their financial outcomes on an annual basis. There are 105,000 properties in the Trepp dataset, covering 2000–2020. The elements of financial data relevant for this paper are the property-level total annual revenue and operating costs, the term of each mortgage, and the appraised or transacted value at mortgage origination. We limit attention to actual (not imputed), full fiscal year financials. Revenue line items can include gross rents, vacancy and credit losses, and parking, laundry, and vending revenue. Operating expenses include management fees, utilities, taxes, maintenance and repairs, insurance, payroll and benefits, advertising and marketing, professional fees, and general and administrative costs. Landlords report the year of completion for any renovation on each property.

The two pieces of information needed to construct landlord returns are property value at the beginning and end of their holding period, and a panel of net income during each holding period. At the beginning of each hold period, we use the appraised or transacted values reported in Trepp. The mortgage data generally does not include valuation at the end of hold periods when a property's mortgage prepays or matures (e.g., by selling or refinancing). We therefore complement the Trepp data with multifamily property transaction values from Yardi. The Yardi data includes transaction values for 49,000 properties, 21,604 of which we can match to the Trepp data using either exact or fuzzy matching on address strings.[1] For these matched properties, we use the Yardi transaction value at the end of each hold period, when available.

To expand the sample, we impute the end-of-holding period valuation for other properties using a CBSA x year x quality segment price index constructed with the universe of transactions in the Yardi dataset. This price index importantly allows for quality-segment-specific appreciation in each city.

Even among properties that consistently report financial data to their CMBS servicer, there is

[1]We exactly match 16,112 properties in the Yardi and Trepp datasets based on address strings, and match a further 4,784 properties fuzzy string matching. We believe this is not an unreasonable match rate given that Trepp only includes properties in CMBS data, which pre-Great Recession was around 10-15% of the overall CRE mortgage market. Fannie Mae and Freddie Mac multifamily securitization expanded after the Great Recession, so our highest match rate is during the 2010–2019 period. As Yardi sources data from a mix of surveys and voluntary contributions from property managers and owners, it is unsurprising that some property transactions recorded in Trepp (particularly refinancings) are not captured in Yardi.

often at least one year of missing net operating income at the beginning or ending of their hold period (e.g., landlords may not be required to report their annual NOI after they sell the property mid-year). Other properties are often missing NOI for some years in the middle of their hold period. We interpolate or extrapolate NOI over these missing observations using the national average NOI growth rate by quality segment (winsorizing at the 5th and 95th percentiles). We only keep property-hold period observations where NOI is not missing for more than 20% of the years where hold periods are greater than 5 years or where NOI is not missing for more than 50% of the time for hold periods less than 5 years (i.e., not missing for more than 1 year of 5 year hold periods, or non-missing for more than 2 of 4 year hold periods). After all of these restrictions, we have a sample of 10,756 property-hold periods.

2.1 Other Datasets

To study geographic variation, we merge in the core-based statistical area-level Wharton Residential Land Use Regulation Index (WRLURI) from Gyourko et al. 2021. We also use data from the Quarterly Census of Employment and Wages (QCEW) on average wage and employment growth across counties.

2.2 Data Description

Table 1 shows summary statistics for the sample of property-level holding periods. The average property has a per unit monthly rental income (i.e., annual revenue per unit divided by 12) of \$1,003, and per unit monthly operating expenses of \$462. In the average hold period, annual revenue growth is 3.7%, while annual expense growth is 4.4%. Net operating income (NOI) grows by 3.6% annually. The average property begins with an average value of \$18.4 million, and ends their hold period with an average value of \$23.6 million, growing 28% over an average period of 6.4 years. The combination of net operating income and growing property values leads to an average internal rate of return (IRR) of 14% during our period of analysis.

To study the role of quality segmentation, we create three categories for quality based on each property's average monthly revenue per unit in the first year of their hold period. In that first year, we assign a quality designation of Low, Mid, or Top quality based on whether the property's rental income per unit is in the bottom, middle, or top tercile within their city's revenue per unit distribution. The distribution of rental income per unit is taken using all existing properties in CMBS loans reporting their financial performance.

Table 1 shows that this method of measuring quality segmentation relates meaningful variation. Lower-quality properties are older on average relative to the top quality properties (built in 1974 vs. 1990), and relatively smaller (185 vs. 246 units). As we would expect, lower-quality properties have lower average values at origination (\$9.4 million vs. \$30.7 million).

From this descriptive table, we can see already that high-quality properties have higher operating incomes and higher operating margins, (NOI divided by revenue), but lower average IRRs. Higher-quality properties take 56.7% of revenues as net income (before debt service), while lower-quality properties take 50.1% of revenues as net income. We observe no evidence that this quality gap is

related to differential hold period length or due to differential probability of renovations around the beginning or during the hold period.

Table 1: Description of Main Sample

	All	Low	Mid	Top
Revenue Per Unit	1003.15	758.14	976.46	1303.07
	(501.08)	(238.59)	(337.93)	(672.78)
Revenue Per Unit Growth	0.037	0.050	0.036	0.025
	(0.110)	(0.162)	(0.071)	(0.067)
Expense Per Unit	461.78	383.43	447.43	563.68
	(217.94)	(104.30)	(131.80)	(319.72)
Expense Per Unit Growth	0.044	0.053	0.042	0.037
	(0.105)	(0.135)	(0.081)	(0.088)
NOI Per Unit	540.25	379.61	526.80	738.47
	(429.97)	(484.56)	(250.39)	(432.74)
NOI Per Unit Growth	0.036	0.048	0.035	0.024
	(0.093)	(0.115)	(0.081)	(0.075)
IRR	0.14	0.16	0.14	0.12
	(0.12)	(0.14)	(0.13)	(0.09)
Value, Origination (millions)	18.41	9.37	16.69	30.69
	(26.08)	(12.06)	(17.94)	(37.80)
Value, End Period (millions)	23.63	12.19	22.14	38.44
	(32.88)	(15.70)	(25.97)	(45.86)
Years of Hold Period	6.39	6.35	6.61	6.19
	(3.53)	(3.60)	(3.54)	(3.43)
Share Renovated Before Hold Period	0.376	0.349	0.388	0.399
	(0.452)	(0.446)	(0.455)	(0.456)
Share Renovated During Hold Period	0.291	0.289	0.284	0.302
	(0.428)	(0.429)	(0.426)	(0.430)
Number of Units	215.69	185.08	211.98	246.35
	(156.02)	(156.83)	(156.84)	(148.75)
Year Built	1981	1974	1980	1990
	(20)	(18)	(17)	(20)
Employment (thousands), CBSA	1403.13	1399.45	1406.08	1405.33
	(1471.83)	(1501.02)	(1529.08)	(1371.34)
Employment Growth, CBSA	0.013	0.014	0.013	0.014
	(0.015)	(0.015)	(0.015)	(0.015)
Share of New Units (%), CBSA	0.900	0.893	0.863	0.944
	(0.553)	(0.557)	(0.531)	(0.566)
Share of New Units >75pctile (%), CBSA	56.780	57.296	56.577	56.380
	(12.653)	(13.318)	(12.116)	(12.363)
Observations	10756	3848	3535	3351

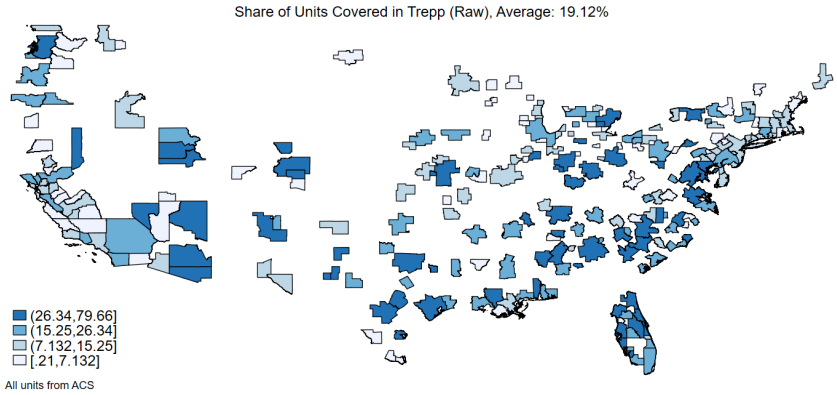
Note: From Trepp and Yardi.

We briefly discuss the data representativeness and selection into CMBS. Where multifamily properties do or do not borrow from lenders who securitize their mortgages is not the main object of this paper, but is relevant insofar as it influences the interpretation of our results. Figure 1a shows that, for the average CBSA, the Trepp data includes 19% of the rental units reported in the Census

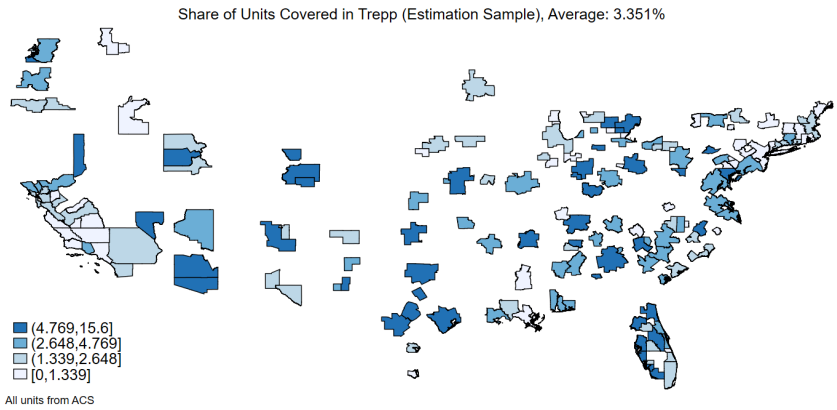
American Community Survey (ACS). Many of those units are in buildings financed by subsidized (Ginnie Mae) mortgages, which do not report financial performance to Trepp. Even among those that do report financial performance and valuations, we drop observations for data quality reasons described above. Our estimation sample (where we feel comfortable computing IRRs) includes 3.35% of the ACS rental unit count in the average CBSA (Figure 1b). This dataset provides better coverage of the overall rental market in areas with less project-based subsidies and in areas with more large multifamily properties or rental communities, meaning less single-family, smaller multifamily (e.g., 2-4 unit structures), or condo-based rental housing.

Figure 1: Map of CMBS (Trepp) Coverage as of 2019

(a) All Properties



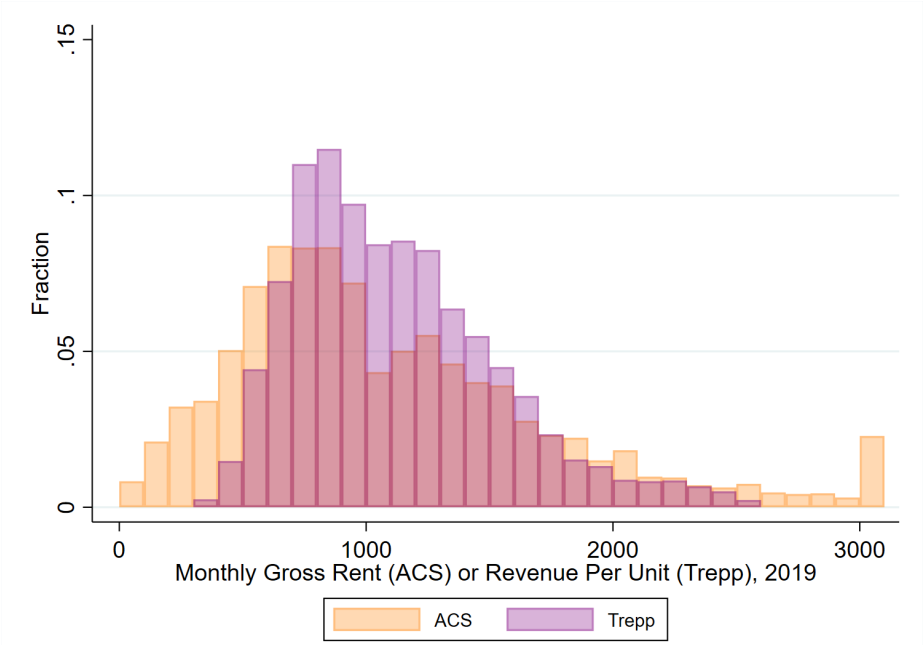
(b) Estimation Sample



Consistent with the geographic coverage, the properties in the estimation sample are concentrated in the middle of the unconditional national rent distribution. We use Census ACS data on reported rents by tenants to construct the national rent distribution in Figure 2. The Census rent distribution has a thick left tail, likely comprised of subsidized buildings and tenants (though the ACS does not ask about rent subsidies). The Census rent distribution also has a large right-tail where 2-3% of rents are top-coded. The estimation sample of CMBS properties does not have the lumpy left-hand side of the distribution because the sample primarily consists of market-rate apartment buildings. There also may be some properties with very high rents that match the long right-tail in the Census

data, but those observations are smoothed because the estimation sample averages rental income across all types of floor plans and apartment sizes within the property. In sum, combining multiple data sources yields a novel sample with detailed information on property cash flows and profitability that covers 48 markets and a sizable share of large market rate apartment buildings in the U.S.

Figure 2: Census Contract Rents vs. CMBS Monthly Rental Revenue Per Unit



2.3 Constructing Returns

Our main measure of returns for landlords is the internal rate of return (IRR) on an unlevered property investment during each "holding period," defined as the period of time between adjacent capital events. In our setting, capital events include any time the landlord realizes the change in their property value. This might be when they buy or sell the property, or when they prepay or refinance the mortgage on the property.

To calculate the IRR we first construct a series of annual cash flows, CF_n, over each individual property-holding period, $n \in \{0, 1, .., N\}$. The cash flow at year 0, CF_0, is the purchase price, $-PurchasePrice$, and for each year through $N-1$, the cash flow, CF_n, is the annual net operating income of the property, NOI_t. In year N, the year of the capital event, the cash flow is the sum of annual NOI and the sale price, $SalePrice + NOI_N$.The internal rate of return IRR of this sequence of cash flows is the yield at which the landlord's discounted present value is equal to zero:

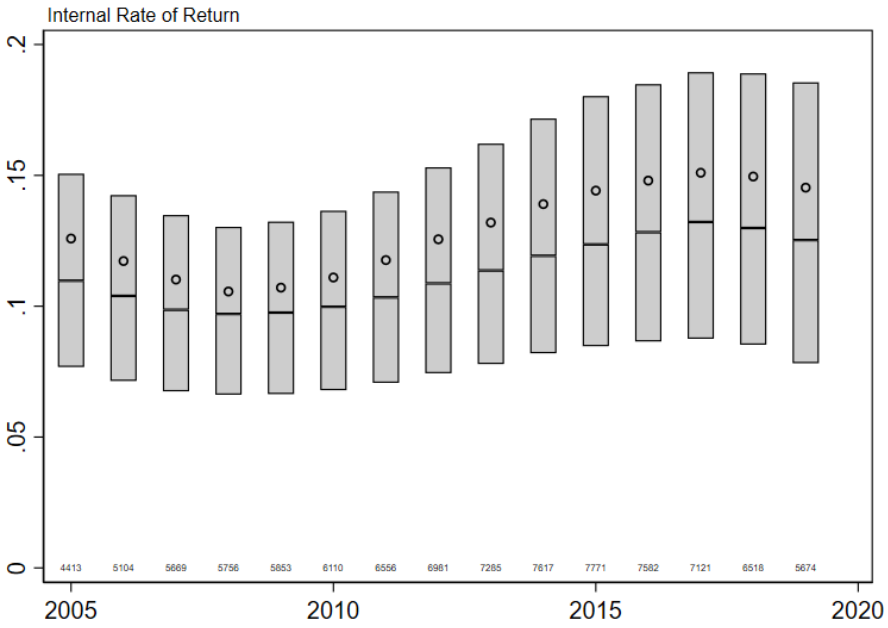
$$\sum_{t=0}^{N} \frac{CF_t}{(1+IRR)^t} = 0 \tag{1}$$

The financial interpretation of the IRR is the percentage rate of return earned on each dollar

invested over N years with variable cash flows. This method to calculate returns is particularly useful in the context of lumpy cash flows in real estate. For example, buying an apartment building requires a large up-front investment and yields noisy annual operating incomes over a fairly long investment horizon.

Figure 3 summarizes the distribution of IRRs in our estimation sample in each year from 2005 to 2019, assigning the annual IRR over the entirety of each hold period to every year represented therein. The figure presents a box plot of IRRs for properties actively operating in each year. The average IRR is shown in circular dots, with the interquartile range in gray box and the median value as the black line in the center of the box. The median IRR is generally between 10% and 15%. The calendar time dynamics suggest that IRRs fell during the housing boom in the mid-2000s. There was a subsequent increase in returns from 2010 to 2018. We compare average IRRs across quality segments in the next section.

Figure 3: Summary of IRR Averaged Over Active Holding Periods



3 Three New Facts on Segmented Rental Markets

3.1 Fact 1: Asking Rents Grew More in the Lower Quality Segment

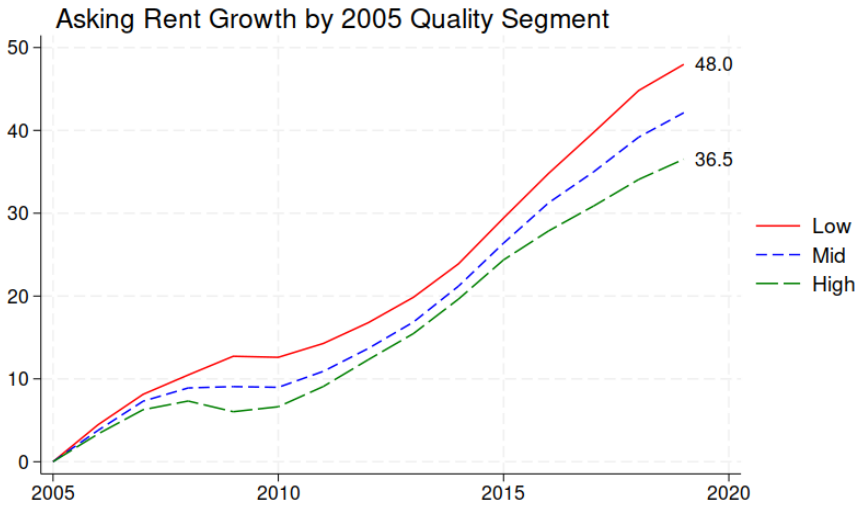
The first fact we present is that asking rents grew more in lower-quality apartment buildings. We use data from Moody's REIS platform, which collects asking rents. Our dataset is a set of market-rate apartment buildings in the 50 largest cities in the U.S. over the 2005–2019 period. To study rent growth by quality, we analyze a constant sample of market-rate properties that have rent data

from 2005 through 2019. This means that the buildings we study are constructed before 2005 and continue operating through the end of our sample period.

To study quality segmentation, we define quality in the beginning of our time period, 2005, by computing each property's percentile of average asking rent in their building within their CBSA. We fix this quality segment from 2005 for the entire period, assigning based on the within-city rent tercile (low, middle, and high). We find minimal movement across quality terciles over time within this set of apartment buildings. Asking rent growth is measured within building starting from the 2005 value of asking rent, and averaged across buildings by quality segment.

Figure 4 presents the results of this exercise, where the cumulative growth starts at zero in 2005 and shows the average growth over time for each segment. Properties in the lowest quality segment experience the highest cumulative rent growth over this period with noticeably higher growth around the Great Recession and late 2010s.[2] The difference in cumulative growth is 11.5 percentage points between lower-quality properties whose rents grew by 48% over 14 years, and the higher-quality properties where rents grew 36.5%. In sum, this exercise shows that the proportional rent growth in the lower-quality segment is meaningfully larger over the period 2005–2019.

Figure 4: Asking Rents Grew More in Lower Quality Segments



3.2 Fact 2: Returns Grew More in the Lower Quality Segment

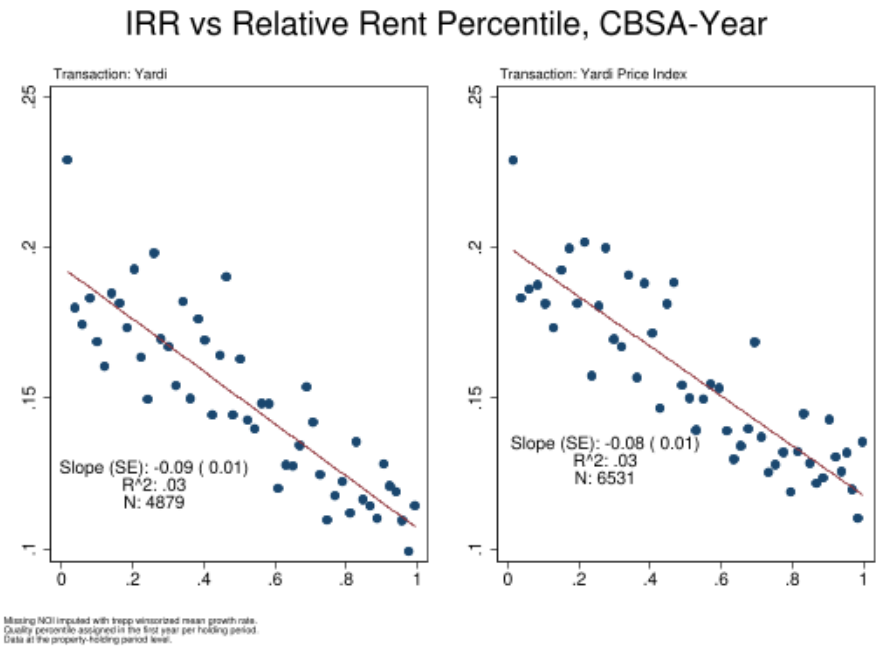
This section examines the IRRs discussed in Section 2.3, comparing IRRs across quality segments, first in the cross-section and then over time. Figure 5 shows the cross-sectional variation in IRRs over the entire time period in a binned scatterplot of IRRs on the y-axis against the relative rent percentile on the x-axis. The relative rent percentile is the percentile that a property's monthly revenue per unit falls in the city-specific distribution of revenue per unit in the first year of the

[2]The figure focuses on growth rates, but because the nominal dollar value of rents begin from a much higher level in the high-quality segment, the high segment actually grew more in raw dollar terms than the lower-quality segments.

property's holding period. This is the same metric that we use to assign properties into quality terciles and quartiles elsewhere in the paper.

The main takeaway from Figure 5 is that higher-quality apartment buildings have lower average returns over our period of analysis. On average, a property ten percentage points higher in the local rent distribution has a 0.8 to 0.9 percentage point lower IRR.

Figure 5: Returns Are Higher in Lower Quality Segments



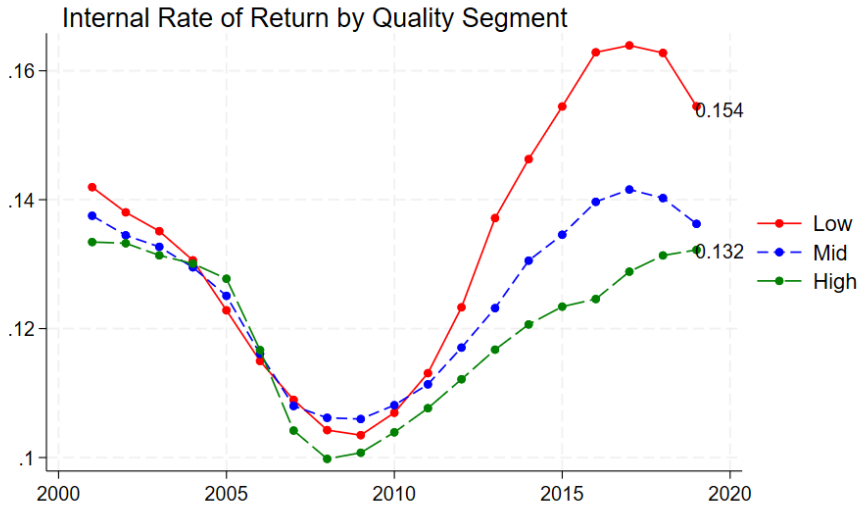
To match our fact on rental returns to the fact on asking rent growth, we need to examine the change in IRRs over time. To do so, we average IRRs by property segment and year across all properties with an active hold period in each year. This calculation provides a measure of the average return on a dollar invested in a property in each quality segment during that year, averaging across all of the years that the dollar could have been originally invested or the years that the holding period could end.[3]

Figure 6 reports the average IRR for the properties in each quality segment with active hold periods in each year. In the early 2000s lower quality properties had higher average returns. Those returns declined and converged in the mid-2000s such that higher-quality properties had slightly higher average IRRs in 2005. Returns bottomed in 2008-2009 with particularly low IRRs among higher-quality properties. From 2010 to 2017, IRRs grew in all quality segments, but differentially

[3]This averaging approach could be relevant because it is conceptually different from many 'total return' calculations that measure the return made on a dollar invested assuming that a property is purchased at the beginning of the year and sold at the end of the year, plus the rental income divided by the assumed purchase price. Eisfeldt and Demers (2015) argue that measurements of total returns map nearly linearly onto IRRs, assuming constant duration, disposition costs, and financing conditions. We note that the assumptions about duration or horizon are potentially important, given that, descriptively, deal volume declined sharply during the Great Recession, and more generally appears to be quite sensitive to interest rate hikes. This is among the first papers to measure changes in IRRs over time using actual holding periods, horizons, values, and operating income.

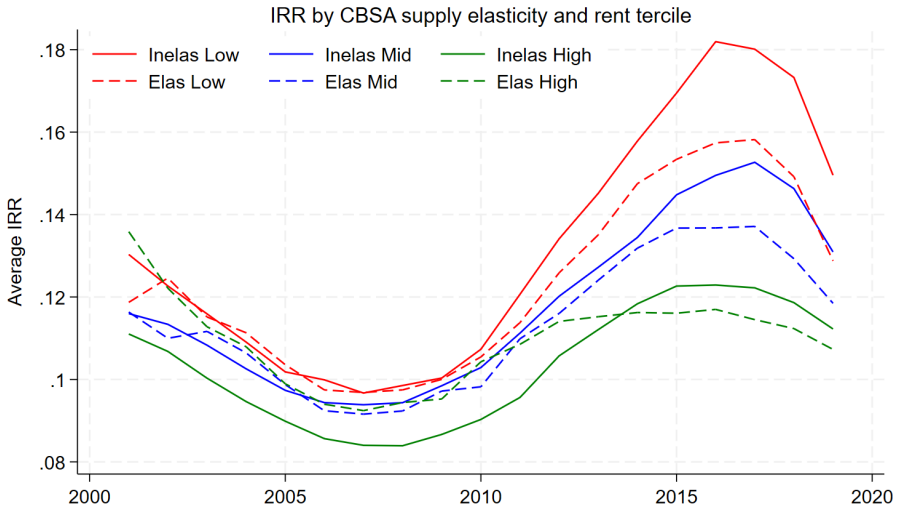
more in the lower-quality segment. In 2019, lower-quality buildings had returns of 15.4%, while higher-quality properties had an average IRR of 13.2%. The difference between the two peaked in 2016-2017 when lower-quality properties experienced average returns of just over 16 percent, and higher-quality properties returns remained below 13 percent. In sum, property-level returns grew disproportionately more in the low-quality segment of the building distribution, especially following the Global Financial Crisis.

Figure 6: Returns Grew More in Lower Quality Segments



We present one addendum to this fact about differential expansion in returns among lower-quality properties: the expansion in IRRs among lower-quality properties occurred nationwide, but was particularly large in cities with the most inelastic housing supply. Figure 7 uses housing supply elasticity measures from Baum-Snow and Han (2024) to show that in the late 2010s cities with below-median supply elasticities have higher IRRs than more elastic cities. This phenomenon appears to be a departure from the 2000s where the within-city returns generally followed a pattern of lower-quality apartments making higher returns, but cross-city patterns suggested that on average, lower-quality and middle-quality properties had comparable IRRs. Higher-quality properties in inelastic cities appear to have had lower IRRs than high-quality properties in more elastic cities. Because data on multifamily mortgage performance is generally not available before the early 2000s, we cannot speak to whether the divergence of returns by quality or by city-level housing supply elasticity is unique to the recovery from the Great Recession or is a more general business cycle or credit cycle phenomenon. In sum, the IRR expansion in the early 2010s affected inelastic cities relatively more than elastic cities.

Figure 7: Returns Grew More in Inelastic Cities & Lower Quality Segments



3.3 Fact 3: Most New Rental Housing Has Entered the Top of the Quality Distribution

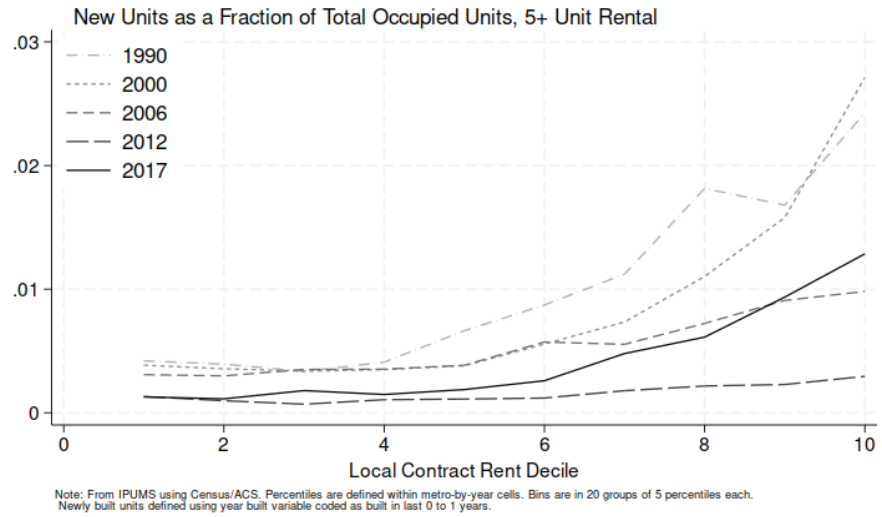
The simplest explanation for why prices or returns may not rise as much in regions with elastic housing supply is that supply expands in response to positive shocks. One of the core insights from our analysis of landlords' returns above is that lower-quality housing became more profitable than higher-quality housing in the 2010s. We investigate that same logic of supply growth, but applied to segmentation within a city.

In this section, we use Census ACS data on the universe of rental housing to establish that, since 1990, most new rental housing entered the top of the quality distribution. As in previous sections, we assign percentiles to each occupied rental unit based on the rent distribution in each city and year. Because of data limitations in how the Census asked about the built year of housing structures, we can only measure entries annually starting in 2008. We focus exclusively on units in "large buildings," i.e., those with 5 or more units.

Figure 8 shows the share of existing rental housing in each decile of the rent distribution that was newly built in each Census year. Going back to the 1990s, new rental housing is heavily skewed towards the top of the rent distribution. This relationship is nearly monotonic, and appears to be consistent regardless of whether the U.S. is building a substantial amount of housing overall (as in 1990 and 2000), or very little (as in 2012 or 2017).

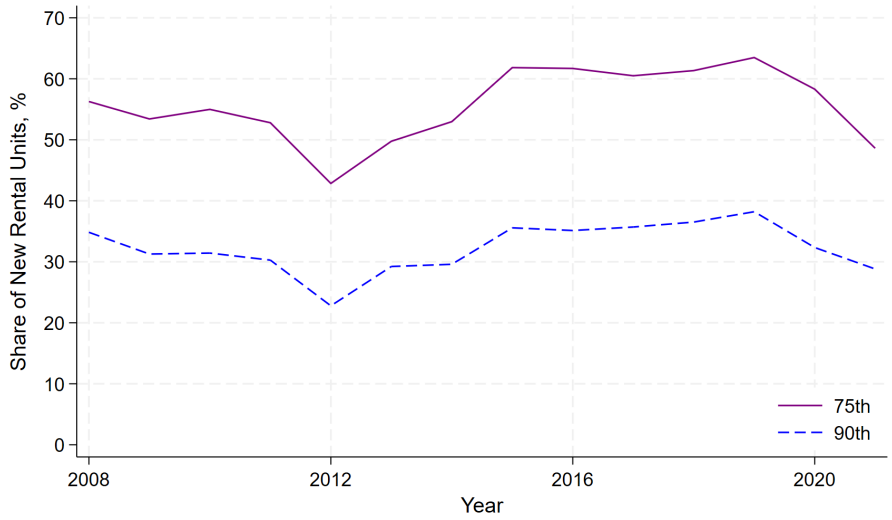
To match this observation to our prior facts, Figure 9 shows the share of newly-built housing in each year whose starting rents fell in the top quartile of the within-city rent distribution for that year. From 2008–2011, 55% of new housing entered the top quartile of the local rent distribution. This percentage dipped in 2012, then rose to more than 60% from 2015–2019. Approximately 30-40% of new housing entered the top ten percent of the local rent distribution over this period with dynamics matching the measure using the top quartile. Taken together, Figures 8 and 9 show that

Figure 8: Most New Housing Enters at the Top of the Quality Distribution



over our time period, most new rental units were more expensive than the average existing unit.

Figure 9: The Share of New Housing Entering the Top of the Local Distribution Has Remained High Across the Cycle



4 Rental Income and IRR Response to Labor Demand Shocks

In this section, we investigate whether rental incomes and returns respond differently to local labor demand shocks by quality segment. To do this we regress returns and NOI growth on city-level employment growth, allowing the effect of employment growth to vary by segment. We find that

lower quality apartments' experience larger increases in NOI and returns compared to medium and high-quality rentals in response to similar employment growth changes. These results hold using a proxy for labor demand growth based on an industry-mix shift-share variable (Bartik 1991).

We then attempt to understand why quality segments respond to demand shocks differently by studying how rental incomes and returns respond to new supply. To the extent that (a) labor demand shocks result in a subsequent increase in new supply and (b) new supply is tilted towards higher-quality apartments, it could be the case that high-quality returns respond less to demand shocks because high-quality new supply is more elastic (and low-quality new supply is relatively inelastic). We test this hypothesis by regressing NOI growth and returns on annual new housing supply allowing effects to vary by quality segment. We find that new supply is strongly related to lower returns for high-quality housing, but less so for existing lower-quality buildings. In addition, directly controlling for new supply explains 30-50% of the differential responsiveness of NOI and returns to labor demand shocks.

4.1 Empirical Strategy

To measure the responsiveness to local demand shocks, we estimate the following equation:

$$y_{it} = \alpha_t + \alpha_c(i) + \beta * \Delta E_{c(i)t} + \epsilon_{it} \tag{2}$$

where y_{it} is an outcome variable for property i located in city c in year t. The coefficient β gives the average effect of a change in employment E_{ct} on the outcome variable $y_{it(c)}$. The outcome variable in the main regressions will be either year-over-year growth in NOI (ΔNOI_{it}) or realized returns over the holding period (IRR_{it}). Because the dependent variable is either growth in NOI or the IRR over the hold period, we do not include property fixed effects in these regressions. Any property-specific variation should be absorbed by differencing net rental incomes, and by calculating a property-specific realized annual return over the hold period (essentially giving us the annual change in the realized return over the holding period). We include city and year fixed effects to isolate the variation coming from labor demand shocks, accounting for the national change within years, and variation specific to particular cities. Standard errors are clustered by city.

We also estimate specifications that instrument for city-level employment with a Bartik shift-share variable, ΔB_{ct}, to identify causal effects of labor demand shocks. Our main concern for identifying labor demand shocks is omitted variable bias: an unobservable shock might drive employment growth and increase rents or property values via an independent channel (e.g., an urban renewal project that is paired with new zoning regulations may boost employment, shifting demand, but also induce new supply). The Bartik instrument isolates the variation in employment that is predicted by national shifts in labor demand and pre-existing local industry employment shares, so would be orthogonal to such idiosyncratic city policy shifts. It is possible, however, firm entry that is predicted by the Bartik shock will be accompanied by commercial development that shifts multifamily housing supply. If this commercial development crowds out housing supply more at the low-end than high-end, it could contribute the differential elasticity of low-end returns to

employment growth.

Our main regression specification modifies the above equation by interacting a quality segment indicator variable with the labor demand shock variable to recover a segment-specific responsiveness of rental income or returns to local demand:

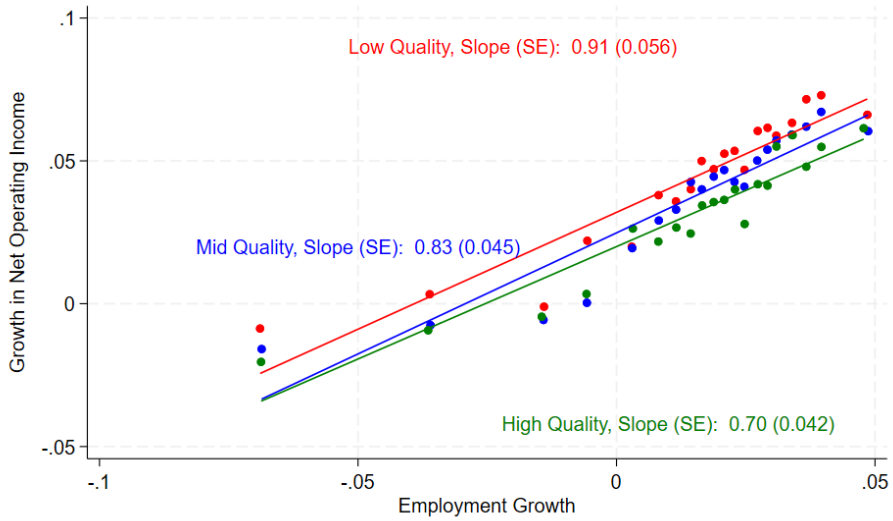
$$y_{it(c)} = \alpha_t + \alpha_c + \beta^q * \Delta E_{ct} * \mathbf{1}[i \in q] + \epsilon_{it(c)} \tag{3}$$

This modification can be represented by an indicator function $\mathbf{1}[i \in q]$, which signifies whether property i is in the bottom, middle, or top tercile of their CBSA's revenue per unit distribution in the year entering the hold period. The quality segment-specific coefficient, β^q, tells us the low-, middle-, and high-quality segment's average change in rental income or returns from a same-size shift in labor demand.

4.2 Responsiveness of Property Cash Flows and Returns to Local Demand Shocks

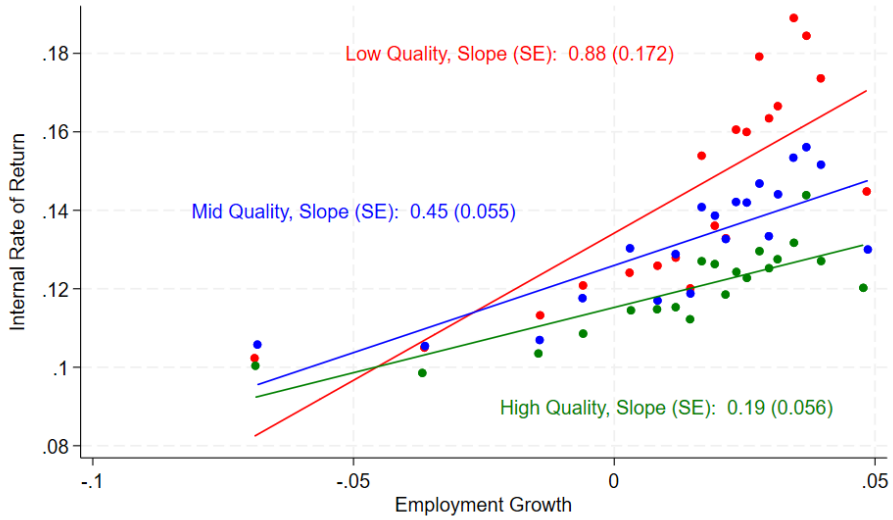
To visualize the variation we use in our main specification, we graph binned scatterplots in Figures 10 and 11. The bins group the data in quantiles separately by quality segment across the x-axis, which is average annual CBSA-level employment growth, and show the variation in the dependent variable on the y-axis. Figure 10 shows the relationship between labor demand growth and annual changes in net operating income, by low (red), middle (blue), and high (green) quality segments. Figure 11 graphs the IRR on the y-axis. The linear slope of an ordinary least squares regression line for each segment is reported in the graph.

Figure 10: Net Rental Income vs. CBSA-Level Employment Growth



The primary takeaway from Figures 10 and 11 is that both rental income (net of actual expenses) and returns are responsive to local demand growth. The next section explores the variation in these

Figure 11: Internal Rate of Return (IRR) vs. CBSA-Level Employment Growth



responses by quality segment. For now we note that, in both graphs, the low-quality segment has a steeper slope than the middle- and high-quality segments, indicating that lower-quality apartment buildings' rental incomes and returns are more responsive to labor demand shocks.

Table 2 shows the average change in annual NOI growth responding to a change in employment growth across the entire sample (without distinguishing property quality segments). A one percentage point higher employment growth rate is associated with 0.821 percent higher growth in net operating income. When accounting for endogeneity using Bartik shift-share variables in an two-stage least squares instrumental variable regression, we observe that one percentage point higher employment growth causes 1.066 percent higher NOI growth. The F-statistic on the first stage regression is 23.68 suggesting limited issues with weak instruments.

Table 3 shows the same regressions with IRR as the dependent variable. The results indicate that over the average holding period, returns are 0.473 ppt higher in response to one percent higher employment growth. Similar to the NOI regression on Bartik shocks, the IRR regression has larger coefficient on the shift-share for employment. The instrumental variables specification yields a slightly smaller effect relative to version without an IV, such that a one percent higher employment growth causes a 0.453 ppt larger internal rate of return.

Table 2: Average Response of NOI to Labor Demand

	NOI Growth (1)	NOI Growth (2)	Emp Growth (3)	NOI Growth (4)
Employment Growth	0.821***			1.066***
	(0.107)			(0.201)
Bartik (3-Digit, Log)		1.272***	1.193***	
		(0.346)	(0.245)	
Spec	OLS	RF	FS	IV
N	74727	74727	74727	74727
F Stats	59.27	13.53	23.68	
CBSA	176	176	176	176
Adjusted R-sq	0.06	0.05	0.86	0.01

Standard errors in parentheses. All specifications include CBSA and year fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Average Response of IRR to Labor Demand

	IRR (1)	IRR (2)	Emp Growth (3)	IRR (4)
Employment Growth	0.473***			0.453***
	(0.151)			(0.151)
Bartik (3-Digit, Log)		0.523***	1.193***	
		(0.169)	(0.245)	
Spec	OLS	RF	FS	IV
N	65903	65903	74727	65903
F Stats	9.88	9.61	23.68	
CBSA	169	169	176	169
Adjusted R-sq	0.05	0.05	0.86	0.00

Standard errors in parentheses. All specifications include CBSA and year fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The main empirical specifications capture the effect of contemporaneous demand shocks on NOI and IRR. We may be concerned that these estimates are driven by differential trends. To test this, we can regress leads of the demand shock variables on rents and returns, and lags of the demand shocks to measure the dynamics of how a marginal change in demand passes through to landlord rents and returns. The results of the dynamic specification are consistent with the main results using contemporaneous labor market shocks.

Figure 12 and 13 show the effects on NOI and IRR, respectively. In the NOI figures, there is a large discrete jump between the first lead, signified as period -1, and the contemporaneous year 0. In both the left-hand panel showing employment growth as the dependent variable and the right-hand panel showing the Bartik shocks, the initial effect of a labor demand shock dissipates

over the following two years. Around half the aggregate effect comes from the second and third year after the shock. Summing up the coefficients provides elasticities that are in line with the main estimates: labor demand shocks significantly increase net rents and returns, and moreso for low-quality buildings (plotted in red).

Figure 12: Distributed Lag Coefficients for Employment Growth and Bartik Effects on NOI Growth

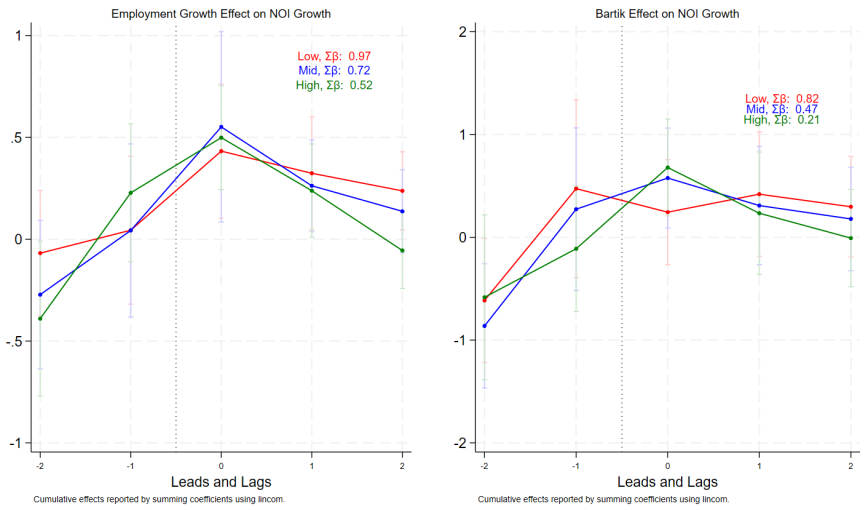
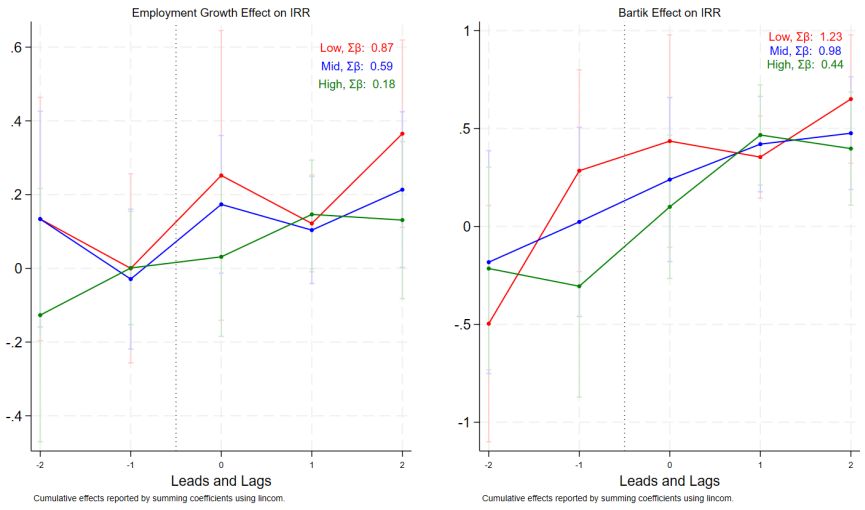


Figure 13: Distributed Lag Coefficients for Employment Growth and Bartik Effects on IRR



4.3 Differential Responsiveness to Local Demand Shocks by Quality Segment

In this subsection, we investigate whether the growth in rental income and returns varies across the quality distribution. We have shown a descriptive version of this test in Figures 10 and 11. Table 4 shows these effects following Equation 3. This specification interacts an indicator variable for each quality segment (Low, Mid, and High quality) with the employment growth varying at the city-by-year level.

Table 4: NOI-employment correlation by quality segment, adding controls

	NOI					
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Employment Growth	0.909***	0.794***		0.816***		0.820***
	(0.117)	(0.113)		(0.116)		(0.114)
Mid Qual X Employment Growth	0.836***	0.828***		0.832***		0.848***
	(0.107)	(0.105)		(0.106)		(0.107)
Top Qual X Employment Growth	0.711***	0.772***		0.754***		0.791***
	(0.104)	(0.094)		(0.094)		(0.098)
Low Qual X New Rental Share		0.023	−0.023	0.225*		
		(0.138)	(0.133)	(0.130)		
Mid Qual X New Rental Share		−0.556***	−0.782***	−0.545***		
		(0.139)	(0.146)	(0.128)		
Top Qual X New Rental Share		−0.712***	−1.230***	−0.925***		
		(0.154)	(0.131)	(0.142)		
Low Qual X New Units >75pctile		0.008***			0.015***	0.013***
		(0.003)			(0.004)	(0.003)
Mid Qual X New Units >75pctile		0.003			0.004	0.000
		(0.003)			(0.003)	(0.003)
Top Qual X New Units >75pctile		−0.003			−0.006*	−0.008***
		(0.003)			(0.003)	(0.003)
Low-High Quality Difference	0.198	0.022		0.062		0.029
P-value Estimates are Different	0.000	0.543		0.093		0.400
Pct Change from Baseline		89.0%		68.4%		85.5%
N	74727	74727	74727	74727	74727	74727
CBSA	176	176	176	176	176	176
Adjusted R-sq	0.06	0.06	0.05	0.06	0.05	0.06

Note: *** p<0.01, ** p<0.05, * p<0.10. All specifications include CBSA and year fixed effects. Standard errors are clustered by CBSA.

Table 5: NOI Bartik effect by quality segment, adding controls

	NOI					
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Bartik (Log)	1.289***	1.129***		1.153***		1.195***
	(0.321)	(0.311)		(0.318)		(0.314)
Mid Qual X Bartik (Log)	1.258***	1.172***		1.172***		1.255***
	(0.312)	(0.306)		(0.310)		(0.309)
Top Qual X Bartik (Log)	1.153***	1.118***		1.093***		1.209***
	(0.314)	(0.304)		(0.309)		(0.309)
Low Qual X New Rental Share		−0.178	−0.023	0.043		
		(0.136)	(0.133)	(0.127)		
Mid Qual X New Rental Share		−0.738***	−0.782***	−0.720***		
		(0.151)	(0.146)	(0.133)		
Top Qual X New Rental Share		−0.921***	−1.230***	−1.135***		
		(0.149)	(0.131)	(0.134)		
Low Qual X New Units >75pctile		0.011***			0.015***	0.016***
		(0.004)			(0.004)	(0.003)
Mid Qual X New Units >75pctile		0.006*			0.004	0.003
		(0.003)			(0.003)	(0.003)
Top Qual X New Units >75pctile		0.000			−0.006*	−0.006*
		(0.003)			(0.003)	(0.003)
Low-High Quality Difference	0.136	0.012		0.060		−0.014
P-value Estimates are Different	0.002	0.791		0.158		0.746
Pct Change from Baseline		91.5%		55.8%		109.9%
N	74727	74727	74727	74727	74727	74727
CBSA	176	176	176	176	176	176
Adjusted R-sq	0.05	0.06	0.05	0.06	0.05	0.05

Note: *** p<0.01, ** p<0.05, * p<0.10. All specifications include CBSA and year fixed effects. Standard errors are clustered by CBSA.

Table 6: IRR-employment correlation by quality segment, adding controls

	IRR					
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Employment Growth	0.819***	0.674***		0.705***		0.685***
	(0.208)	(0.186)		(0.196)		(0.182)
Mid Qual X Employment Growth	0.424***	0.424***		0.433***		0.425***
	(0.147)	(0.141)		(0.145)		(0.141)
Top Qual X Employment Growth	0.153	0.290**		0.269**		0.287**
	(0.146)	(0.130)		(0.131)		(0.130)
Low Qual X New Rental Share		0.659*	0.994***	0.926***		
		(0.374)	(0.345)	(0.316)		
Mid Qual X New Rental Share		−0.128	−0.285	−0.092		
		(0.196)	(0.176)	(0.196)		
Top Qual X New Rental Share		−0.708***	−1.336***	−0.991***		
		(0.238)	(0.243)	(0.238)		
Low Qual X New Units >75pctile		0.012*			0.027***	0.021***
		(0.007)			(0.008)	(0.006)
Mid Qual X New Units >75pctile		0.006			0.005	0.005
		(0.004)			(0.004)	(0.004)
Top Qual X New Units >75pctile		−0.002			−0.014***	−0.012***
		(0.005)			(0.005)	(0.004)
Low-High Quality Difference	0.666	0.384		0.435		0.398
P-value Estimates are Different	0.000	0.001		0.000		0.000
Pct Change from Baseline		42.4%		34.6%		40.2%
N	65903	65903	65903	65903	65903	65903
CBSA	169	169	169	169	169	169
Adjusted R-sq	0.06	0.06	0.06	0.06	0.06	0.06

Note: *** p<0.01, ** p<0.05, * p<0.10. All specifications include CBSA and year fixed effects. Standard errors are clustered by CBSA.

Table 7: IRR Bartik effect by quality segment, adding controls

	IRR					
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Bartik (Log)	0.795***	0.625***		0.656***		0.636***
	(0.190)	(0.176)		(0.179)		(0.168)
Mid Qual X Bartik (Log)	0.467***	0.411***		0.412***		0.448***
	(0.159)	(0.155)		(0.156)		(0.153)
Top Qual X Bartik (Log)	0.257	0.294*		0.259		0.355**
	(0.171)	(0.162)		(0.168)		(0.160)
Low Qual X New Rental Share		0.631*	0.994***	0.944***		
		(0.372)	(0.345)	(0.325)		
Mid Qual X New Rental Share		−0.274	−0.285	−0.242		
		(0.179)	(0.176)	(0.178)		
Top Qual X New Rental Share		−0.922***	−1.336***	−1.241***		
		(0.220)	(0.243)	(0.237)		
Low Qual X New Units >75pctile		0.015*			0.027***	0.025***
		(0.008)			(0.008)	(0.008)
Mid Qual X New Units >75pctile		0.008*			0.005	0.006
		(0.005)			(0.004)	(0.004)
Top Qual X New Units >75pctile		−0.001			−0.014***	−0.013***
		(0.005)			(0.005)	(0.004)
Low-High Quality Difference	0.538	0.331		0.398		0.281
P-value Estimates are Different	0.000	0.001		0.001		0.002
Pct Change from Baseline		38.4%		26.1%		47.8%
N	65903	65903	65903	65903	65903	65903
CBSA	169	169	169	169	169	169
Adjusted R-sq	0.05	0.06	0.06	0.06	0.06	0.06

Note: *** p<0.01, ** p<0.05, * p<0.10. All specifications include CBSA and year fixed effects. Standard errors are clustered by CBSA.

We observe in Column (1) of Table 4 that city-level employment growth increases net rental income by 0.9 percent for properties in the lower-quality segment, while higher-quality properties increase by 0.7 percent. Below the coefficients, we report a panel showing the difference between the low- and high-quality coefficients as well as a p-value from a t-test that the coefficients are equal. This specification implies that the same employment growth rate has 20 percent less effect on rental income growth for higher-quality properties, and this difference is statistically significant above the 99 percent confidence level. Using the Bartik shock version of the specification leads to an estimated differential responsiveness of 14 percent between low- and high-quality properties, remaining statistically significant (Table 5).

Studying the differential response of returns to demand shocks in Column (1) of Table 6 shows that the average relationship may mask substantial heterogeneity by quality segment. One percent higher employment growth increases average IRRs by 0.819 percentage points for lower-quality properties, but by only 0.153 for higher-quality properties. The high-quality coefficient is 67 percent smaller than the low-quality coefficient, a difference that is highly statistically significant. Table 7 shows analogous regressions using Bartik shocks as proxies for local demand. The effects are quite similar: Lower-quality property IRRs are 54 percent more responsive to demand shocks than higher-quality property returns.

4.4 Does Housing Supply Help Explain the Differential Responsiveness to Local Demand Shocks?

In this subsection, we unpack the differential responsiveness of lower and higher-quality rental properties to local demand shocks. The key issue to address is whether low- and higher-quality properties respond similarly to new housing entering the market in their city, and whether the differences in overall new supply can explain (statistically) why demand shocks affect lower-quality properties' rental income and returns more than high-quality properties'.

Table 4 Column (3) interacts the quality indicator variables with a city-by-year level variable, 'New Rental Share', which captures how much new rental housing is entering the market. The new rental share variable is constructed as the number of occupied rental housing units that were constructed over the current or prior year divided by the total number of occupied rental housing units in the city. In the average city, 0.9 percent of rental units are newly constructed (see Table 1).

New occupied rental supply has strong negative effects on rental income, though this effect is concentrated among higher-quality properties. One percent more new rental supply is related to 1.2 percent lower NOI for high-quality properties, and only 0.02 percent lower NOI for lower-quality properties. In Column (5) of Table 4, we observe a positive relationship between the share of new supply entering the top of the quality distribution and NOI growth of existing lower-quality buildings. There is an imprecise negative relationship with NOI growth for higher quality properties. Columns (4) and (6) add the direct supply controls into regressions with employment growth, while column (2) includes both supply control variables together. From this, if we assume that directly controlling for supply captures the channel by which demand shocks could be differentially affected through new housing, we observe that the gap between low versus high quality employment coefficients narrows

by 89%, such that the low and high quality coefficients are no longer significantly different from one another. This exercise is repeated in Table 5. Similar to Table 4, lower-quality properties respond more to demand shocks, and about half of this differential responsiveness can be explained by the response of new rental housing supply.

In Tables 6 and 7, we study the effect of local demand on landlords' returns. We regress the property-by-holding period IRR on annual changes in labor demand. The differential responses are even more pronounced whether we use employment growth directly or Bartik shocks. On average, one percent higher employment growth is correlated with 0.819 percentage points higher IRR for lower-quality properties, while it is associated with 0.153 ppt higher returns on higher-quality properties (67% smaller than the lower-quality segment coefficient). The effect on the higher-quality segment is not statistically significant, while the lower-quality segment effect is significantly different from zero above the 99 percent confidence level.

We observe that new rental supply has significant negative effects on returns for higher-quality properties and, if anything, positive effects on returns for lower-quality properties. Controlling for the new rental supply in Column (2) explains 38-42% of the differential response to demand shocks, reducing the size of the lower quality segment coefficient and increasing the higher quality segment coefficient in Tables 6 and 7.

5 Robustness

Our main facts and supply-side explanation are robust to various alternative interpretations. In Appendix B, we show that our results are not driven by a quality bias in either renovations or delinquencies; outsized responsiveness of low-end cap rates to falling interest rates; or segment-specific local demand shocks.

Approximately 32% of the sample reports a renovation in the 2 years before and the years during the hold period, and this subsample reports higher returns (14.6% relative to 12.6% for the hold periods without property upgrades). If these renovations are more likely to occur for low-end properties in high-demand growth areas, underreporting of the capital expenses associated with these upgrades would low-end returns upwards and drive a correlation between these returns and local demand shocks. Appendix B.1 shows, however, that our results persist in the two subsamples of hold periods that include renovations and those that do not.

One also might be concerned that differential changes in returns between low- and high-quality properties are due to differences in the share of loans in distress. Property owners with delinquent loans might respond differently to local demand shocks (e.g., liquidating or selling in a weak market), for example, and be more likely to report financials to CMBS servicers. Appendix B.2 shows that excluding distressed properties does little to change our overall story.

Our main specifications estimate the elasticity of segment-specific property performance to aggregate local demand shocks. If the growth in employment we measure and instrument with Bartik shocks is driven by low-wage workers who cannot afford high-end apartments, it is natural that they would tend to drive larger performance gains in low-end properties. Instead, Appendix B.4 shows that low-end cashflow increases *more* in CBSAs with high-income population growth. High-end

cashflows actually increase slightly less in markets with disproportionate high-income population growth, though this differential disappears after controlling for new high-end housing supply.

Below we propose that the relative inelasticity of low-end housing supply to local demand growth compensates low-end property investors for either contrarian bets on low-end rent growth or differential risks associated with low-end investments. An alternative explanation is that these investors benefited from outsized cap rate compression due to falling interest rates. That is, they purchased properties at higher caps that had further to fall as interest rates dropped. We instead find that properties with higher entry caps see less pass-through of interest rate declines to returns. Our main results are also robust to directly including controls for this alternative mechanism.

6 Discussion

In this paper we have shown that low-end properties saw higher growth in operating cash flows and realized more appreciation in the growing multifamily market between the Great Recession and the COVID pandemic. We hypothesize that these differentials are due to relatively inelastic supply of low-end units. Demand growth was met with new high-end supply, mitigating rent growth and appreciation at the high end of the market, but not the low end.

We use variation in these dynamics across markets to develop our case. We show that the low end of the market saw more operating cashflow growth and higher returns than the high-end in markets with higher local employment growth, even when instrumented with Bartik shocks. This differential falls by over two-thirds after controlling for local new supply and the share of new supply at the high-end.

The next step in this research is to better understand the reason for limited low-end supply. One explanation relates to the cost of capital. In efficient capital markets, the outsized returns generated by supply frictions in the asset market must compensate investors for taking on more risk or making a contrarian bet. A recent literature has considered the role of rent non-payment risk in adjusting landlord behavior (Abramson and Van Nieuwerburgh 2024; Bezy et al. 2024). Other sources of risk to low-end landlords include policy risk (such as the potential introductions of rent controls or eviction moratoria) or long-run price volatility, which itself may be exacerbated by supply inelasticity. Which of these factors is most important in explaining new low-end supply will help direct policy to address the imbalances that we identify in this paper.

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Appendix

A Data Appendix

TBD

B Robustness: Other Explanations for Outsized Low-End Property Performance

In this Appendix, we assess the robustness of our main facts and results to various alternative explanations. In particular, we show that the outsized NOI growth and returns that we measure at the low-end of the market, or the demonstrated role of high-end biased new supply in generating these differentials, are not explained by a quality bias in either renovations or delinquencies; outsized responsiveness of low-end cap rates to falling interest rates; or segment-specific local demand shocks.

B.1 Renovations

Are the changes in returns driven by quality/capital improvements of existing rental housing rather than the differential responses of new supply? In this section, we test this potential confounding mechanism. One might be concerned that the differential aggregate IRR growth, and the differential responsiveness of low-end returns to local demand growth, is due to under-reporting of capital expenditures in the CMBS data we use to measure returns. If such capital expenditures are correlated with local demand shocks and those quality changes differ across the quality distribution, they could confound our main estimates. The proposed channel of this confounder is that a positive demand shock could cause low-quality landlords to renovate or improve their building, leading to a larger rent increase or cap rate compression, which we attribute to the differential demand response channel.

We address this confounder using an indicator for renovations that we observe in the Trepp data. Annual NOI growth is nearly identical during hold periods that include renovations and those that do not (3.67 and 3.63 percent, respectively), but IRRs are about 2 percentage points higher during renovation hold periods (14.6 percent) than during non-renovation hold periods (12.6 percent). The return differential suggests that our results could be explained by property upgrades whose costs are not reported in our data.

To illustrate whether capital or quality improvements are driving our main results, we split the estimation sample into properties that experience a renovation during or in the 2 years before a hold period versus properties that have no record of a renovation or quality improvement in their financial reporting. In Table B.1, columns (1)-(2) replicate the main results, while columns (3)-(4) show the results with only non-renovated properties and columns (5)-(6) include only properties with a recorded renovation. Approximately 32% of the sample has a renovation in the years just before and during a hold period—this is not surprising given the reporting about apartment quality improvements during the 2010s (e.g., Reher 2021).

We find that the differential demand response is not driven by quality improvements. Non-renovated properties if anything show an even larger differential demand response in column (3), while renovated properties respond somewhat less to local demand shocks. This is not entirely surprising if new renovations take several years to complete, have higher rent levels on the lease-up of new units, and perhaps have additional frictions or constraints associated with meeting target returns on investment based on the newly renovated units. Table B.2 shows that these same results are broadly consistent using the Bartik shock measure of local labor demand. In both cases, adding the supply controls closes or even reverses the differential demand responsiveness of high- and low-quality apartments. This suggests that new supply, and adding new supply when demand grows matters quite a lot, even for newly renovated apartment buildings.

Table B.1: IRR-employment correlation by quality segment, properties with and without renovations

	IRR					
	All Properties		Not Renovated		Renovated	
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Employment Growth	0.819***	0.674***	0.755***	0.635***	0.904***	0.713***
	(0.208)	(0.186)	(0.194)	(0.172)	(0.244)	(0.222)
Mid Qual X Employment Growth	0.424***	0.424***	0.405***	0.429***	0.424**	0.412**
	(0.147)	(0.141)	(0.141)	(0.136)	(0.203)	(0.182)
Top Qual X Employment Growth	0.153	0.290**	0.209	0.295**	0.080	0.311*
	(0.146)	(0.130)	(0.128)	(0.118)	(0.209)	(0.185)
Low Qual X New Rental Share		0.659*		0.660*		0.436
		(0.374)		(0.350)		(0.497)
Mid Qual X New Rental Share		−0.128		0.299		−1.022***
		(0.196)		(0.234)		(0.362)
Top Qual X New Rental Share		−0.708***		−0.734***		−0.394
		(0.238)		(0.251)		(0.416)
Low Qual X New Units >75pctile		0.012*		0.012*		0.015
		(0.007)		(0.006)		(0.011)
Mid Qual X New Units >75pctile		0.006		−0.001		0.017
		(0.004)		(0.004)		(0.011)
Top Qual X New Units >75pctile		−0.002		0.006		−0.023**
		(0.005)		(0.005)		(0.010)
Low-High Quality Difference	0.666	0.384	0.546	0.339	0.824	0.403
P-value Estimates are Different	0.000	0.001	0.000	0.001	0.000	0.005
Pct Change from Baseline		42.4%	18.1%	49.1%	−23.7%	39.5%
N	65903	65903	44562	44562	21340	21340
CBSA	169	169	165	165	146	146
Adjusted R-sq	0.06	0.06	0.07	0.07	0.06	0.07

Note: *** p<0.01, ** p<0.05, * p<0.10. All specifications include CBSA and year fixed effects. Standard errors are clustered by CBSA.

B.2 Delinquent Loans

Are the differential changes in returns driven by differences in mortgage distress? Delinquency, default, and foreclosure could confound our main estimates through two different mechanisms. First, if distressed landlords in low-quality segments are differentially less likely to report their financial

Table B.2: IRR Bartik effect by quality segment, properties with and without renovations

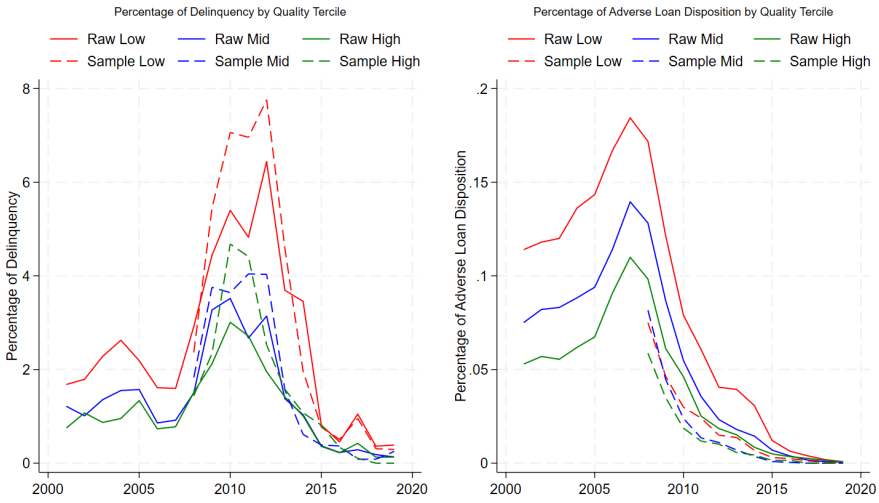
	IRR					
	All Properties		Not Renovated		Renovated	
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Bartik (Log)	0.795***	0.625***	0.613***	0.472***	1.153***	0.954***
	(0.190)	(0.176)	(0.180)	(0.173)	(0.278)	(0.257)
Mid Qual X Bartik (Log)	0.467***	0.411***	0.321**	0.301**	0.757***	0.691**
	(0.159)	(0.155)	(0.148)	(0.145)	(0.284)	(0.265)
Top Qual X Bartik (Log)	0.257	0.294*	0.211	0.209	0.406	0.550**
	(0.171)	(0.162)	(0.156)	(0.148)	(0.274)	(0.271)
Low Qual X New Rental Share		0.631*		0.611*		0.435
		(0.372)		(0.353)		(0.492)
Mid Qual X New Rental Share		−0.274		0.153		−1.169***
		(0.179)		(0.214)		(0.356)
Top Qual X New Rental Share		−0.922***		−0.934***		−0.614
		(0.220)		(0.235)		(0.419)
Low Qual X New Units >75pctile		0.015*		0.014**		0.018
		(0.008)		(0.007)		(0.011)
Mid Qual X New Units >75pctile		0.008*		0.000		0.019*
		(0.005)		(0.005)		(0.011)
Top Qual X New Units >75pctile		−0.001		0.007		−0.021**
		(0.005)		(0.005)		(0.010)
Low-High Quality Difference	0.538	0.331	0.402	0.263	0.747	0.404
P-value Estimates are Different	0.000	0.001	0.002	0.008	0.000	0.001
Pct Change from Baseline		38.4%	25.3%	51.1%	−38.8%	24.9%
N	65903	65903	44562	44562	21340	21340
CBSA	169	169	165	165	146	146
Adjusted R-sq	0.05	0.06	0.06	0.07	0.06	0.07

Note: *** p<0.01, ** p<0.05, * p<0.10. All specifications include CBSA and year fixed effects. Standard errors are clustered by CBSA.

outcomes, the IRR construction could have differentially more imputed values. This could be considered a form of non-classical measurement error, potentially biasing our estimates of low-quality IRRs upwards by applying average NOI growth or value appreciation to distressed property. Second, distressed properties may behave differently in responding to local demand shocks. It is unclear what direction this would bias our estimates: if landlords abandon managing the property, then those distressed apartments may become extremely unresponsive to local demand shocks; on the other hand, this form of distress might heavily drive changes in returns if distressed properties are forced to sell or liquidate in a down market.

Figure B.1 shows the time series trends in the percent of outstanding mortgages delinquent in each given month and the percent that experience an adverse event. The adverse loan disposition is inclusive of foreclosure, liquidation, and forced sales. It is clear from these graphs that distress and forced sales are more common among low-quality properties.

Figure B.1: Percent of Delinquent Loans and Adverse Loan Dispositions in Raw Trepp Data and Estimation Sample, by quality segment



In the next figure, we study whether excluding properties that ever experience distress changes our main facts about returns for landlords. Figure B.2 shows that overall excluding distressed properties does little to change the overall story: low-quality properties' returns are higher and they rise much faster post-Great Financial Crisis. It is possible that the inclusion and imputation of NOI and returns for lower quality properties leads use to overestimate returns in 2010-2014 and underestimate returns from 2015-2019. It appears likely that the differences in returns are mostly driven by appreciation and realization, because Figure B.2 shows that NOI is higher, on average, in the sample excluding delinquent properties during 2010-2015.

Figure B.2: Property Performance for Delinquent and Non-Delinquent Loans, by quality segment



B.3 Falling Interest Rates

One popular explanation for cap rate and return dynamics over the 2010s is that as interest rates declined towards zero, the cap rate distribution compressed. Naturally (the story goes), a marginal interest rate change has a larger effect on cap rates (and therefore prices and returns) for lower-quality buildings because lower-quality buildings' cap rates had further to fall. We propose several potential tests of this hypothesis.

First in Table B.3, we regress internal rates of return (average annual returns over a hold period) on the change in 10-year Treasury yields over the hold period. To allow the effect of yield compression to vary, we interact the change in Treasury yields with the own-property entry cap rate. We find that changes in our proxy for risk-free rates are positively correlated with IRRs. The interaction between entry cap rate and change in yields is negative, suggesting that at relatively higher cap rates, Treasury yields actually pass through less to returns. The second column shows that this interaction effect essentially disappears when controlling for the entry cap rate. The final columns show suggestive evidence that part of the differential responsiveness of IRRs to local demand shocks may be related to differences in initial costs of the investment. However, this empirical approach may be problematic because the entry cap rate is a component of the IRR (the cost basis for the investment), generating a mechanical (one-for-one) relationship with returns.

Appendix Tables C.7 through Table C.10 replicate Table B.3 using four different specifications to capture initial cost of capital: national-level Treasury yields, which only vary by year; CBSA-level cap rates which vary over CBSA and years; national quality segment-specific cap rates which vary by segment and year; and CBSA-level quality segment-specific average entry cap rates, varying at the CBSA-by-segment-by-year level. Because we impute prices and IRRs on properties currently operating at the end of our dataset in 2020, we drop those properties in this specification so as not to overweight the unusual aspects of the 2020 COVID economy. Each of these specifications shows

Table B.3: Segment-specific IRR-employment correlation, controlling for Own-Entry Cap

	IRR						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
d(10yr Treasury Yield)	0.054***	0.022***		0.054***	0.054***	0.022***	0.023***
	(0.003)	(0.002)		(0.003)	(0.002)	(0.002)	(0.002)
d(10yr Yield) X Entry Cap Rate	-0.322***	0.036**		-0.322***	-0.323***	0.033*	0.030*
	(0.013)	(0.018)		(0.013)	(0.012)	(0.017)	(0.016)
Entry Cap Rate		1.123***				1.114***	1.106***
		(0.066)				(0.064)	(0.062)
Low Qual X Employment Growth			0.802***	0.745***	0.590***	0.548***	0.443***
			(0.201)	(0.168)	(0.146)	(0.116)	(0.101)
Mid Qual X Employment Growth			0.397***	0.315***	0.316***	0.289***	0.298***
			(0.134)	(0.109)	(0.103)	(0.084)	(0.081)
Top Qual X Employment Growth			0.140	0.105	0.194**	0.145*	0.203***
			(0.126)	(0.105)	(0.093)	(0.078)	(0.071)
Low Qual X New Rental Share					0.066		0.126
					(0.247)		(0.214)
Mid Qual X New Rental Share					-0.213		-0.139
					(0.155)		(0.131)
Top Qual X New Rental Share					-0.745***		-0.483***
					(0.226)		(0.146)
Low Qual X New Units >75pctile					0.017***		0.012***
					(0.005)		(0.004)
Mid Qual X New Units >75pctile					-0.002		-0.002
					(0.004)		(0.003)
Top Qual X New Units >75pctile					-0.009***		-0.005**
					(0.003)		(0.003)
Constant	0.160***	0.063***	0.123***	0.155***	0.157***	0.060***	0.061***
	(0.003)	(0.005)	(0.002)	(0.003)	(0.003)	(0.005)	(0.005)
N	51352	51352	51352	51352	51352	51352	51352
CBSA	167	167	167	167	167	167	167
Adjusted R-sq	0.46	0.60	0.06	0.46	0.47	0.61	0.61

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA. All specifications include CBSA and year fixed effects.

that the change in Treasury yields is positively related to average returns conditional on year and CBSA fixed effects. In the case of segment or CBSA-specific cap rates, controlling for the initial cost basis seems to have a one-for-one or 1.2-1.3 relationship with IRR.

There is essentially no evidence that an outsized response of low-end property values to declining treasury yields explains the outsized low-end return growth. If higher cap rate segments of the market were more responsive to falling interest rates, then the d(Treasury yield) x entry cap coefficient would be positive: properties with larger initial cap rate should see greater return growth when treasury rates fall. Instead, nearly every specification shows the opposite result: properties with higher initial

cap rates see less return growth in response to changes in treasury rates. It appears that controlling for these proxies for changes in treasury rates and the initial cost basis/entry cap rate explain some of the differential responsiveness to local demand shocks across segments. However, none of the cap rate specifications fully explain the low- vs. high-quality gap, and the housing supply variables still explain a portion of the different responses separately from the cost of capital controls.

B.4 Outsized Low-End Demand Growth

TBD

Table B.4: NOI employment effect by quality segment, adding controls for segment-specific demand shocks

	NOI				
	(1)	(2)	(3)	(4)	(5)
Low Qual X Employment Growth	0.900***	0.795***	0.732***		0.711***
	(0.116)	(0.113)	(0.119)		(0.118)
Mid Qual X Employment Growth	0.817***	0.803***	0.786***		0.757***
	(0.106)	(0.104)	(0.110)		(0.107)
Top Qual X Employment Growth	0.700***	0.751***	0.780***		0.743***
	(0.105)	(0.095)	(0.105)		(0.100)
Low Qual X New Rental Share		−0.024		−0.248*	−0.030
		(0.137)		(0.144)	(0.140)
Mid Qual X New Rental Share		−0.585***		−0.787***	−0.555***
		(0.137)		(0.160)	(0.138)
Top Qual X New Rental Share		−0.708***		−0.953***	−0.704***
		(0.149)		(0.140)	(0.151)
Low Qual X New Units >75pctile		0.007**		0.009**	0.006**
		(0.003)		(0.004)	(0.003)
Mid Qual X New Units >75pctile		0.004		0.007**	0.004
		(0.003)		(0.003)	(0.003)
Top Qual X New Units >75pctile		−0.002		0.002	−0.001
		(0.003)		(0.003)	(0.003)
Low Qual X Δ High Inc HH			0.144***	0.139***	0.077***
			(0.023)	(0.027)	(0.023)
Mid Qual X Δ High Inc HH			0.026	0.119***	0.040*
			(0.020)	(0.026)	(0.022)
Top Qual X Δ High Inc HH			−0.042**	0.110***	0.031
			(0.021)	(0.026)	(0.023)
Low Qual X Δ Low Inc HH			−0.026	−0.040	−0.061*
			(0.032)	(0.033)	(0.032)
Mid Qual X Δ Low Inc HH			−0.062*	−0.029	−0.050
			(0.037)	(0.035)	(0.036)
Top Qual X Δ Low Inc HH			0.012	0.073**	0.048
			(0.033)	(0.033)	(0.032)
Low-High Quality Difference	0.200	0.044			−0.032
P-value Estimates are Different	0.000	0.204			0.445
Pct Change from Baseline		78.2%			115.7%
N	76485	76485	76485	76485	76485
CBSA	176	176	176	176	176
Adjusted R-sq	0.06	0.06	0.06	0.06	0.06

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

C Additional Tables and Figures

Table C.1: Average Response of NOI to Labor Demand

	NOI Growth	NOI Growth	Emp Growth	NOI Growth
	(1)	(2)	(3)	(4)
Employment Growth	0.796***			1.027***
	(0.105)			(0.207)
New Rental Share	-0.407***	-0.604***	-0.272**	-0.325**
	(0.122)	(0.125)	(0.118)	(0.151)
New Units >75pctile	0.003	0.006**	0.004**	0.002
	(0.002)	(0.003)	(0.002)	(0.002)
Bartik (3-Digit, Log)		1.189***	1.157***	
		(0.340)	(0.242)	
Spec	OLS	RF	FS	IV
N	74727	74727	74727	74727
F Stats	29.50	10.53	9.63	
CBSA	176	176	176	176
Adjusted R-sq	0.06	0.05	0.87	0.01
Year FE	Yes	Yes	Yes	Yes
CBSA FE	Yes	Yes	Yes	Yes

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

Table C.2: Average Response of IRR to Labor Demand

	IRR	IRR	Emp Growth	IRR
	(1)	(2)	(3)	(4)
Employment Growth	0.466***			0.459***
	(0.151)			(0.166)
New Rental Share	0.004	-0.121	-0.272**	0.002
	(0.197)	(0.173)	(0.118)	(0.200)
New Units >75pctile	0.006*	0.008**	0.004**	0.006*
	(0.003)	(0.004)	(0.002)	(0.004)
Bartik (3-Digit, Log)		0.512***	1.157***	
		(0.178)	(0.242)	
Spec	OLS	RF	FS	IV
N	65903	65903	74727	65903
F Stats	4.10	5.20	9.63	
CBSA	169	169	176	169
Adjusted R-sq	0.05	0.05	0.87	0.00
Year FE	Yes	Yes	Yes	Yes
CBSA FE	Yes	Yes	Yes	Yes

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

Table C.3: NOI employment effect by quality segment, adding volatility

	NOI					
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Employment Growth	0.906***	0.797***		0.908***		0.783***
	(0.118)	(0.115)		(0.118)		(0.109)
Mid Qual X Employment Growth	0.821***	0.806***		0.815***		0.790***
	(0.108)	(0.106)		(0.104)		(0.100)
Top Qual X Employment Growth	0.707***	0.758***		0.704***		0.757***
	(0.106)	(0.097)		(0.104)		(0.094)
Low Qual X New Rental Share		−0.028			−0.293**	−0.023
		(0.141)			(0.142)	(0.138)
Mid Qual X New Rental Share		−0.593***			−0.924***	−0.638***
		(0.141)			(0.178)	(0.142)
Top Qual X New Rental Share		−0.728***			−1.059***	−0.760***
		(0.155)			(0.152)	(0.151)
Low Qual X New Units >75pctile		0.007**			0.012***	0.009***
		(0.003)			(0.004)	(0.003)
Mid Qual X New Units >75pctile		0.003			0.005	0.002
		(0.003)			(0.003)	(0.003)
Top Qual X New Units >75pctile		−0.003			−0.002	−0.004*
		(0.003)			(0.003)	(0.003)
Volatility			−0.007	−0.007	−0.029***	−0.026***
			(0.007)	(0.006)	(0.008)	(0.007)
Low-High Quality Difference	0.198	0.038				0.026
P-value Estimates are Different	0.000	0.277				0.450
Pct Change from Baseline		80.8%				87.0%
N	76043	76043	76043	76043	76043	76043
CBSA	167	167	167	167	167	167
Adjusted R-sq	0.06	0.06	0.05	0.06	0.06	0.06

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

Table C.4: IRR employment effect by quality segment, adding volatility

	IRR					
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Employment Growth	0.807***	0.671***		0.803***		0.664***
	(0.204)	(0.186)		(0.205)		(0.183)
Mid Qual X Employment Growth	0.467***	0.457***		0.478***		0.449***
	(0.150)	(0.146)		(0.151)		(0.143)
Top Qual X Employment Growth	0.182	0.327**		0.188		0.325**
	(0.152)	(0.136)		(0.152)		(0.134)
Low Qual X New Rental Share		0.629*			0.503	0.629*
		(0.341)			(0.331)	(0.343)
Mid Qual X New Rental Share		−0.127			−0.338	−0.151
		(0.225)			(0.209)	(0.222)
Top Qual X New Rental Share		−0.624**			−0.846***	−0.643**
		(0.253)			(0.220)	(0.253)
Low Qual X New Units >75pctile		0.011*			0.017**	0.012*
		(0.007)			(0.008)	(0.007)
Mid Qual X New Units >75pctile		0.007			0.007	0.006
		(0.005)			(0.005)	(0.005)
Top Qual X New Units >75pctile		−0.005			−0.007	−0.006
		(0.005)			(0.005)	(0.005)
Volatility			0.017	0.011	−0.017**	−0.014*
			(0.011)	(0.008)	(0.008)	(0.007)
Low-High Quality Difference	0.625	0.344				0.338
P-value Estimates are Different	0.000	0.001				0.001
Pct Change from Baseline		45.0%				45.9%
N	66960	66960	66960	66960	66960	66960
CBSA	161	161	161	161	161	161
Adjusted R-sq	0.05	0.05	0.04	0.05	0.05	0.05

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

Table C.5: NOI employment effect by quality segment, adding LIHTC share

	NOI					
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Employment Growth	0.900***	0.795***		0.860***		0.795***
	(0.116)	(0.113)		(0.115)		(0.111)
Mid Qual X Employment Growth	0.817***	0.803***		0.820***		0.802***
	(0.106)	(0.104)		(0.105)		(0.102)
Top Qual X Employment Growth	0.700***	0.751***		0.743***		0.752***
	(0.105)	(0.095)		(0.103)		(0.094)
Low Qual X New Rental Share		−0.024			−0.294**	−0.024
		(0.137)			(0.149)	(0.137)
Mid Qual X New Rental Share		−0.585***			−0.874***	−0.600***
		(0.137)			(0.171)	(0.137)
Top Qual X New Rental Share		−0.708***			−0.988***	−0.698***
		(0.149)			(0.150)	(0.153)
Low Qual X New Units >75pctile		0.007**			0.010**	0.007**
		(0.003)			(0.004)	(0.003)
Mid Qual X New Units >75pctile		0.004			0.007*	0.003
		(0.003)			(0.003)	(0.003)
Top Qual X New Units >75pctile		−0.002			0.001	−0.002
		(0.003)			(0.003)	(0.003)
Low Qual X Sh. New LIHTC Units			1.750***	1.198**	0.493	0.014
			(0.538)	(0.470)	(0.559)	(0.504)
Mid Qual X Sh. New LIHTC Units			0.174	−0.221	0.765	0.312
			(0.508)	(0.469)	(0.593)	(0.528)
Top Qual X Sh. New LIHTC Units			−1.486***	−1.635***	0.207	−0.224
			(0.558)	(0.495)	(0.583)	(0.526)
Low-High Quality Difference	0.200	0.044				0.043
P-value Estimates are Different	0.000	0.204				0.211
Pct Change from Baseline		78.2%				78.5%
N	76485	76485	76485	76485	76485	76485
CBSA	176	176	176	176	176	176
Adjusted R-sq	0.06	0.06	0.05	0.06	0.06	0.06

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

Table C.6: IRR employment effect by quality segment, adding LIHTC share

	IRR					
	(1)	(2)	(3)	(4)	(5)	(6)
Low Qual X Employment Growth	0.793***	0.660***		0.756***		0.670***
	(0.199)	(0.182)		(0.192)		(0.181)
Mid Qual X Employment Growth	0.453***	0.445***		0.434***		0.448***
	(0.146)	(0.142)		(0.144)		(0.142)
Top Qual X Employment Growth	0.172	0.317**		0.254*		0.324**
	(0.148)	(0.133)		(0.144)		(0.132)
Low Qual X New Rental Share		0.626*			0.566*	0.698**
		(0.332)			(0.324)	(0.336)
Mid Qual X New Rental Share		−0.122			−0.362*	−0.186
		(0.218)			(0.207)	(0.219)
Top Qual X New Rental Share		−0.611**			−0.779***	−0.586**
		(0.245)			(0.219)	(0.251)
Low Qual X New Units >75pctile		0.011*			0.019**	0.014**
		(0.006)			(0.008)	(0.006)
Mid Qual X New Units >75pctile		0.007			0.004	0.003
		(0.005)			(0.004)	(0.004)
Top Qual X New Units >75pctile		−0.005			−0.006	−0.005
		(0.005)			(0.005)	(0.004)
Low Qual X Sh. New LIHTC Units			1.855**	0.756	−1.420	−1.799**
			(0.927)	(0.846)	(0.944)	(0.907)
Mid Qual X Sh. New LIHTC Units			0.218	0.192	1.184	0.922
			(1.090)	(1.066)	(1.074)	(1.067)
Top Qual X Sh. New LIHTC Units			−4.024***	−3.405***	−0.505	−0.713
			(1.224)	(1.046)	(0.925)	(0.907)
Low-High Quality Difference	0.621	0.343				0.346
P-value Estimates are Different	0.000	0.001				0.001
Pct Change from Baseline		44.7%				44.3%
N	67302	67302	67302	67302	67302	67302
CBSA	169	169	169	169	169	169
Adjusted R-sq	0.05	0.06	0.05	0.05	0.05	0.06

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

Table C.7: Cap Rate Compression Using Treasury Yield

	IRR (1)	IRR (2)	IRR (3)	IRR (4)	IRR (5)	IRR (6)	IRR (7)
d(10yr Treasury Yield)	0.103***	0.103***		0.101***	0.100***	0.101***	0.100***
	(0.006)	(0.006)		(0.006)	(0.006)	(0.006)	(0.006)
d(10yr Yield) X Entry Yield	-0.015***	-0.015***		-0.015***	-0.015***	-0.015***	-0.015***
	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)
Entry 10yr Treasury Yield		0.000				0.000	0.000
		(.)				(.)	(.)
Low Qual X Employment Growth			0.802***	0.631***	0.512***	0.631***	0.512***
			(0.201)	(0.166)	(0.145)	(0.166)	(0.145)
Mid Qual X Employment Growth			0.397***	0.277***	0.253**	0.277***	0.253**
			(0.134)	(0.104)	(0.099)	(0.104)	(0.099)
Top Qual X Employment Growth			0.140	0.029	0.106	0.029	0.106
			(0.126)	(0.100)	(0.090)	(0.100)	(0.090)
Low Qual X New Rental Share					0.257		0.257
					(0.264)		(0.264)
Mid Qual X New Rental Share					-0.450**		-0.450**
					(0.175)		(0.175)
Top Qual X New Rental Share					-0.809***		-0.809***
					(0.264)		(0.264)
Low Qual X New Units >75pctile					0.009		0.009
					(0.006)		(0.006)
Mid Qual X New Units >75pctile					0.005		0.005
					(0.004)		(0.004)
Top Qual X New Units >75pctile					-0.007		-0.007
					(0.005)		(0.005)
Constant	0.168***	0.168***	0.123***	0.164***	0.165***	0.164***	0.165***
	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
N	51352	51352	51352	51352	51352	51352	51352
CBSA	167	167	167	167	167	167	167
Adjusted R-sq	0.11	0.11	0.06	0.11	0.12	0.11	0.12
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CBSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

Table C.8: Cap Rate Compression Using CBSA-Level Entry Cap Rate

	IRR						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
d(10yr Treasury Yield)	0.066***	0.039***		0.066***	0.066***	0.039***	0.039***
	(0.005)	(0.004)		(0.005)	(0.005)	(0.004)	(0.004)
d(10yr Yield) X Entry Cap Rate, CBSA	-0.455***	-0.141***		-0.454***	-0.454***	-0.144***	-0.147***
	(0.034)	(0.042)		(0.034)	(0.034)	(0.042)	(0.042)
Entry Cap Rate, CBSA		0.936***				0.925***	0.915***
		(0.090)				(0.088)	(0.087)
Low Qual X Employment Growth			0.802***	0.723***	0.579***	0.647***	0.516***
			(0.201)	(0.167)	(0.146)	(0.143)	(0.123)
Mid Qual X Employment Growth			0.397***	0.358***	0.344***	0.309***	0.301***
			(0.134)	(0.108)	(0.102)	(0.086)	(0.082)
Top Qual X Employment Growth			0.140	0.082	0.177*	0.023	0.119
			(0.126)	(0.104)	(0.092)	(0.088)	(0.075)
Low Qual X New Rental Share					0.146		0.254
					(0.238)		(0.229)
Mid Qual X New Rental Share					-0.342*		-0.277
					(0.197)		(0.183)
Top Qual X New Rental Share					-0.714***		-0.615**
					(0.254)		(0.243)
Low Qual X New Units >75pctile					0.014**		0.012**
					(0.006)		(0.005)
Mid Qual X New Units >75pctile					0.002		0.002
					(0.005)		(0.004)
Top Qual X New Units >75pctile					-0.011**		-0.010*
					(0.005)		(0.005)
Constant	0.162***	0.084***	0.123***	0.157***	0.159***	0.080***	0.082***
	(0.003)	(0.007)	(0.002)	(0.003)	(0.003)	(0.007)	(0.007)
N	51352	51352	51352	51352	51352	51352	51352
CBSA	167	167	167	167	167	167	167
Adjusted R-sq	0.17	0.20	0.06	0.18	0.18	0.20	0.20

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA. All specifications include CBSA and year fixed effects.

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

Table C.9: Cap Rate Compression Using National-Level Quality Segment Entry Cap Rate

	IRR						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
d(10yr Treasury Yield)	0.082***	0.044***		0.082***	0.083***	0.049***	0.053***
	(0.009)	(0.010)		(0.009)	(0.009)	(0.010)	(0.010)
d(10yr Yield) X Entry Cap Rate, Q	-0.608***	-0.173		-0.608***	-0.613***	-0.224**	-0.273**
	(0.084)	(0.119)		(0.084)	(0.084)	(0.114)	(0.109)
Entry Cap Rate, Q		1.293***				1.138***	1.010***
		(0.232)				(0.204)	(0.189)
Low Qual X Employment Growth			0.837***	0.730***	0.568***	0.642***	0.511***
			(0.207)	(0.172)	(0.148)	(0.151)	(0.134)
Mid Qual X Employment Growth			0.432***	0.284***	0.288***	0.339***	0.350***
			(0.141)	(0.108)	(0.103)	(0.105)	(0.102)
Top Qual X Employment Growth			0.174	0.071	0.150	0.189*	0.231**
			(0.129)	(0.102)	(0.092)	(0.097)	(0.092)
Low Qual X New Rental Share					0.359		0.368
					(0.239)		(0.230)
Mid Qual X New Rental Share					-0.452**		-0.427**
					(0.180)		(0.177)
Top Qual X New Rental Share					-0.837***		-0.677***
					(0.245)		(0.237)
Low Qual X New Units >75pctile					0.015**		0.013**
					(0.006)		(0.005)
Mid Qual X New Units >75pctile					0.001		-0.000
					(0.004)		(0.004)
Top Qual X New Units >75pctile					-0.006		-0.003
					(0.005)		(0.004)
Constant	0.166***	0.058***	0.122***	0.161***	0.162***	0.066***	0.077***
	(0.004)	(0.017)	(0.002)	(0.003)	(0.003)	(0.016)	(0.016)
N	51072	51072	51072	51072	51072	51072	51072
CBSA	167	167	167	167	167	167	167
Adjusted R-sq	0.12	0.13	0.06	0.13	0.13	0.13	0.13

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA. All specifications include CBSA and year fixed effects.

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.

Table C.10: Cap Rate Compression Using CBSA-Level Quality Segment Entry Cap Rate

	IRR						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
d(10yr Treasury Yield)	0.066***	0.034***		0.065***	0.066***	0.035***	0.035***
	(0.008)	(0.007)		(0.008)	(0.007)	(0.007)	(0.007)
d(10yr Yield) X Entry Cap Rate, Q-CBSA	-0.445***	-0.089		-0.445***	-0.446***	-0.096	-0.102
	(0.067)	(0.071)		(0.066)	(0.066)	(0.071)	(0.070)
Entry Cap Rate, Q-CBSA		1.096***				1.076***	1.059***
		(0.107)				(0.101)	(0.098)
Low Qual X Employment Growth			0.837***	0.767***	0.609***	0.582***	0.465***
			(0.207)	(0.172)	(0.149)	(0.123)	(0.109)
Mid Qual X Employment Growth			0.432***	0.355***	0.352***	0.319***	0.332***
			(0.141)	(0.112)	(0.106)	(0.087)	(0.084)
Top Qual X Employment Growth			0.174	0.123	0.218**	0.160**	0.228***
			(0.129)	(0.103)	(0.094)	(0.079)	(0.074)
Low Qual X New Rental Share					0.094		0.174
					(0.241)		(0.223)
Mid Qual X New Rental Share					-0.259*		-0.171
					(0.153)		(0.136)
Top Qual X New Rental Share					-0.676***		-0.407**
					(0.232)		(0.173)
Low Qual X New Units >75pctile					0.018***		0.014***
					(0.005)		(0.005)
Mid Qual X New Units >75pctile					0.000		-0.001
					(0.004)		(0.003)
Top Qual X New Units >75pctile					-0.010***		-0.007**
					(0.004)		(0.003)
Constant	0.162***	0.069***	0.122***	0.156***	0.157***	0.066***	0.068***
	(0.003)	(0.008)	(0.002)	(0.003)	(0.003)	(0.008)	(0.008)
N	51072	51072	51072	51072	51072	51072	51072
CBSA	167	167	167	167	167	167	167
Adjusted R-sq	0.23	0.29	0.06	0.23	0.24	0.29	0.30

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA. All specifications include CBSA and year fixed effects.

Note: *** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered by CBSA.