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Is a Lack of Competition Exacerbating Inflation? – Note by Jacob Linger, Hal Singer, Ted Tatos

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Is a Lack of Competition Exacerbating Inflation? A Case Study of Florida Rental Markets[*]

By Jacob Linger, Hal Singer, Ted Tatos[**]

Specific sectors of the U.S. economy, such as electricity, rental, and food, substantially contribute to overall inflation, and each of these sectors has experienced increasing concentration. Although correlation between concentration and inflation does not imply a causal nexus between the two, concentration can exacerbate inflation, by, inter alia, facilitating price coordination. To investigate this relationship, we examine multi-family rental properties in Florida, areas of which have exhibited rampant inflation. For each Census Tract in the state, we calculate the consolidation of properties from 2015 through 2022, and then test whether such consolidation explains increases in rental prices or increases in rental inflation or both, controlling for other factors that might confound the concentration-inflation relationship. We find statistically significant effects in both relationships. The policy implication of such findings is that, rather than leaning on the Federal Reserve to combat rental inflation by raising interest rates, legislative bodies or regulatory authorities could impose ownership limits on holdings within a given Census Tract.

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1. Introduction

A basic tenet of economics is that, all things equal, concentrated industries are more susceptible to coordinated pricing—indeed, antitrust laws exist because concentrated power in the trusts made it easier to fix prices.[1] It is easier to coordinate with two rivals in an oligopoly than with twenty in a competitive industry. This is why antitrust is rightly concerned about coordinated price effects, in addition to unilateral price effects, when reviewing mergers.[2] In his seminal book, *Lectures in Antitrust Economics*, Michael Whinston describes the two challenges for a cartel or firms seeking to reach a higher-priced equilibrium: the incentive problem and the coordination problem.[3] The cover of inflation solves both.

Regarding the incentive problem, a firm is less likely to join a cartel and raise prices to monopoly levels if its customers will react harshly to the price hike. Consumer resistance to price hikes may soften with inflation because there now is a pretext for the price increase. If consumers view price increases as the outcome of widespread economic cost increases and thus inescapable, they are less likely to attempt to evade the price increases by substituting to other products, including outside of the cartel. Moreover, inflation raises search costs as prices move frequently, making it more difficult to discern if price rises are reasonable or not. Regarding the coordination problem, in the absence of an explicit agreement that stipulates price levels, coordination is hard because there are typically many possible price points and the firms have to pick one, presumably without communicating. Inflation solves this problem by providing a floor for future price increases—for example, if general inflation is seven percent, we should raise our prices by at least seven percent. Inflation basically provides a "focal point" that allows firms to figure out how to raise prices on consumers without communicating.

To explore the relationship between concentration (the key independent variable) and rents or rental inflation (the dependent variables), we create a panel dataset of Florida property concentration and rents from 2015-2022. We then employ both OLS and instrumental variable regression models to identify the impact of concentration levels on rents and rental inflation, while holding other explanatory factors constant. Our paper is organized as follows. In Part I, we describe the data set used to estimate our model. In Part II, we describe the economic model and the hypothesis to be tested. In Part III, we present our results, both before and after instrumenting for HHI. Part IV provides the policy implications of our findings.

2. Background

The OECD's Background Note on Competition and Inflation (2022) explains a "potential feedback effect if inflation itself led to reductions in competition, which in turn led to

[1].*See* AMY KLOBUCHAR, ANTITRUST: TAKING ON MONOPOLY POWER FROM THE GILDED AGE TO THE DIGITAL AGE 39-61 (Knopf 2021). In the extreme form of concentration, monopoly, coordination occurs *within* the firm's boundaries. And other factors, such as transparency or response times can affect coordination.

[2].Department of Justice & Federal Trade Commission, Horizontal Merger Guidelines, Aug. 18, 2010, Section 7 ("Coordinated Effects").

[3].MICHAEL WHINSTON, LECTURES IN ANTITRUST ECONOMICS 21 (MIT Press 2008).

further systematic price increases."[4] It goes on to note how high inflation, by causing prices to change frequently, could "provide the perfect cover to align and increase prices together."[5] Pricing algorithms, made possible by advances in technology, could "potentially mak[e] it easier for firms to monitor and react to firms in some markets."[6] Citing the work of Gwin and Taylor (2004), the OECD's Note explains that by making it "harder for consumers to identify information on prices, firms are likely to face less effective competition from rivals [during periods of inflation], and can raise prices accordingly."[7] Although it does not conclude that competition is a key driver of inflation, the OECD's Note does conclude that there is a "strong basis to think that supporting competitive markets will have an overall beneficial effect on inflation."[8]

A growing empirical literature connects inflation and competition (or the lack thereof). Bräuning et. al (2022) find a significantly higher rate of pass-through from cost shocks in concentrated industries.[9] Singer (2022) finds that the largest bouts of U.S. inflation in 2021 emanated from the most concentrated industries in 2020.[10] Konzcal and Lusiani (2022) find that U.S. firms that increased markups in 2021 the most were those with the higher mark-ups prior to the economic shocks.[11] Przybyla and Roma (2005) find correlations between inflation and several metrics for competition for EU countries between 1980 and 2001.[12] Cavelaars (2003) finds that two measures of competition—markups and the OECD Product Market Regulation indicators—are negatively and significantly related to average inflation

[4].OECD, Competition and Inflation, OECD Competition Policy Roundtable Background Note, Oct. 2022, at 10, *available at* www.oecd.org/daf/competition/competition-and-inflation-2022.pdf.

[5].*Id*. at 16.

[6].*Id*.

[7].*Id*. at 17.

[8].*Id*. at 15.

[9].Falk Bräuning, Jose Fillat & Gustavo Joaquim, Cost-Price Relationships in a Concentrated Economy, Federal Reserve Bank of Boston Research Paper Series Current Policy Perspectives Paper No. 94265 (2022), *available at* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4118181.

[10].Hal Singer, Testimony to the House Committee on Economic Disparity and Fairness in Growth, (Im)Balance of Power: How Market Concentration Affects Worker Compensation and Consumer Prices, Apr. 6, 2022, *available at* https://fairgrowth.house.gov/sites/democrats.fairgrowth.house.gov/files/documents/Singer%20HHRG-117-EF00-Wstate-SingerH-20220406.pdf.

[11].Mike Konczal and Niko Lusiani, Prices, Profits, and Power: An Analysis of 2021 Firm-Level Markups, Roosevelt Institute Brief June 2022, *available at* https://rooseveltinstitute.org/publications/prices-profits-and-power/

[12].Marcin Przybyla & Moreno Roma, *Does Product Market Competition Reduce Inflation? Evidence From EU Countries And Sectors*, *available at* http://ssrn.com/abstract_id=676404.(accessed on 3May2022). *See also* Jürgen Janger and Philipp Schidt-Dengler, The Relationship between Competition and Inflation, Austrian Central Bank 2010, *available at* https://ideas.repec.org/a/onb/oenbmp/y2010i1b3.html (finding evidence of a negative relationship between inflation and competitive intensity).

over the period 1988 to 2000 for 21 countries.[13] Duca and VanHoose (2000) find that a metric for goods-market competition in the United States is negatively related to inflation.[14]

Although general inflation began to fall below nine percent in the United States in August 2022, the CPI for "Shelter," comprised of "Rent of primary residencies" plus "Owners equivalent rents of residences," continued rising, reaching levels above nine percent.[15] Shelter contributes 32 percent to the total CPI and about 40 percent of core inflation.[16] With the exception of the onset of Covid, housing inflation has generally tracked overall inflation. In 2022, rents were up almost 15 percent in the Miami/Atlanta metro area and by 21 percent in Phoenix.[17] Per Zillow research, renters face growing housing affordability hurdles in the United States; renters in Miami, for example, need to work 96 hours at the average wage to pay the typical rent.[18] In ten U.S. cities, including Atlanta, Jacksonville, Tampa and Orlando, institutional investors, defined as entities owning over 100 properties nationwide, had previously acquired at least 15 percent of all single-family rental units.[19] This suggests a possible nexus between concentration (in levels) and rental inflation.

Economists have recently begun to explore the relationships between institutional investment and home and rental prices. Researchers at the Federal Reserve Bank of St. Louis (2020) found that purchases by institutional investors, as measured by the share of properties owned by all institutional investors collectively in a Metropolitan Statistical Area (MSA), increase (1) the price-to-income ratio, especially in the bottom price-tier, the entry point for first-time buyers, and (2) the rent-to-income ratio generally,[20] especially where the housing supply elasticity is high.[21] By treating all institutional investors in the aggregate and thus *as if* it were owned a single entity, however, the St. Louis Fed study may have overlooked the incremental explanatory power of clustering properties by a single institutional owner in a given neighborhood. Put differently, an MSA with (say) ten

[13].Paul Cavelaars, *Does Competition Enhancement Have Permanent Inflation Effects?*, 56(1) KYKLOS, 69-94, *available at* https://doi.org/10.1111/1467-6435.00210.

[14].John V. Duca and David D. VanHoose, *Has Greater Competition Restrained U. S. Inflation?*, 66(3) SOUTHERN ECONOMIC JOURNAL, 729-741 (2000), *available at* https://doi.org/10.2307/1061435.

[15].See Paul Krugman, *Wonking Out, What's Really Happening to Inflation*, NEW YORK TIMES, Oct. 14, 2022 (citing FRED data), *available at* https://www.nytimes.com/2022/10/14/opinion/inflation-numbers-housing.html. Krugman explains that rents and owners' equivalent rents (OER), or what homeowners would be paying if they were renters based on market rents, are two big components of the CPI. It is more common to refer to shelter as "accommodation" outside the United States.

[16].*Id*.

[17].See Joseph Politano, America's Fractured Housing Market, Apricitas Economics, Sept. 21, 2022, *available at* https://www.apricitas.io/p/americas-fractured-housing-market.

[18].See Jeff Tucker, *Renters Need to Work 63 Hours to Pay Rent, Six More Than Before the Pandemic*, ZILLOW RESEARCH, Nov. 21, 2022, *available at* https://www.zillow.com/research/hours-worked-to-pay-rent-31704/.

[19].John Burns Real Estate Consulting, *available at* https://twitter.com/RickPalaciosJr/status/1576657409170296833/photo/1.

[20].Carlos Garriga, Pedro Gete, and Athena Tsouderou, Investors and Housing Affordability, Economic Research Federal Reserve Bank of St. Louis Working Paper Series, 2020-047A, at Figure 4, available at https://s3.amazonaws.com/real.stlouisfed.org/wp/2020/2020-047.pdf [hereafter *St. Louis Fed Study*].

[21].*Id*. at 12-13.

percent institutional ownership, split equally across ten owners, could exhibit different pricing dynamics than an MSA with ten percent institutional ownership split equally across just two owners.[22]

Tapp and Peiser (2022) identify an antitrust framework that would better discern between increased institutional investment and increased concentration more generally.[23] Using a database comprised of all multifamily real estate transactions of greater than $2 million, they estimated the distribution of HHIs across all Opportunity Zones within the US, showing that investors have grown to consolidate a growing share of the affordable rental housing market.[24] Additionally, they highlight a few of the common strategies used by investors to do this—such as through M&A activity, integration of rental holdings across subsectors, and horizontal cooperation.[25] While Tapp and Peiser (2022) address a framework for identifying increases in rental concentration, they do not provide a direct linkage between concentration and rent prices.

Watson and Ziv (2021) address this gap by analyzing the relationship between ownership concentration and rents in New York City, finding that a ten percent increase in concentration is correlated with a one percent increase in rents.[26] They caution against interpreting their results causally, however, as they do not control for the potential "endogeneity" in concentration—that is, the possibility that concentration (an independent variable) is determined by the same forces that shape rental prices (the dependent variable), leading to biased estimates in the regression. Gurun et. al (2022) examine concentration in single-family rental markets.[27] To address the endogeneity issue, they employ a difference-in-differences model, exploiting three large institutional mergers to identify a treatment effect. They estimate that neighborhoods in which a merger permitted a single entity to control more than five properties realized an increase in rents by 0.51-1.62 percent, but that roughly half of this increase was due to a resulting endogenous reduction in crime.[28] While their study appears to be the most robust in producing causal estimates, it only accounts for concentration changes to single-family rental properties. This ignores a significant rental property type—larger multi-family apartment buildings—which are most pronounced in major metropolitan locations. We address this evidentiary gap by estimating the

[22]. *See also* Jung Sakong, *Effect of ownership composition on property prices and rents: Evidence from Chinese investment boom in US housing markets*, Federal Reserve Bank of Chicago Working Paper No. WP 2021-12 (2021), *available at* https://www.chicagofed.org/~/media/publications/working-papers/2021/wp2021-12-pdf.pdf. Sakong uses an interaction between China to US travel times and Chinese American presence within a ZIP code to instrument for Chinese capital influx. Contrary to Garriga et. al (2020), Sakong finds that institutional investment *decreases* rents.

[23].Renee Tapp and Richard Peiser, *An antitrust framework for housing*, 0(0) EPA: ECONOMY AND SPACE (2022), *available at* https://journals.sagepub.com/doi/10.1177/0308518X221135612.

[24]. *Id.* at 7-11.

[25]. *Id.* at 16.

[26].C. Luke Watson and Oren Ziv, *Is the Rent too High? Land Ownership and Monopoly Power*, cesifo Working Papers (2021), *available at* https://www.cesifo.org/DocDL/cesifo1_wp8864.pdf.

[27].Gurun et. al, *Do Wall Street Landlords Undermine Renters' Welfare?*, REVIEW OF FINANCIAL STUDIES (2022) hhac017, *available at* https://academic.oup.com/rfs/advance-article-abstract/doi/10.1093/rfs/hhac017/6550515?redirectedFrom=fulltext.

[28]. *Id*. at 18-19.

relationship between ownership concentration and rents *across all* rental property types in Florida.

The location of properties owned by the institutional owners could influence pricing dynamics. Housing stock is not homogeneous across locations; consumers exhibit spatial preferences based on a variety of factors: schools, walkability, proximity to the ocean, shopping or other amenities, and so forth. To explore these agglomerative and market-power effects, we obtained Florida property tax roll data to assess whether institutional owners randomly purchase properties throughout a city, or instead acquire rental stock strategically in select neighborhoods within an urban area to achieve market power or soften competition via coordination.[29] We present an example of this in Appendix 1, which displays clustering among the top five property owners within the South Shore neighborhood from 2015 to 2022.[30]

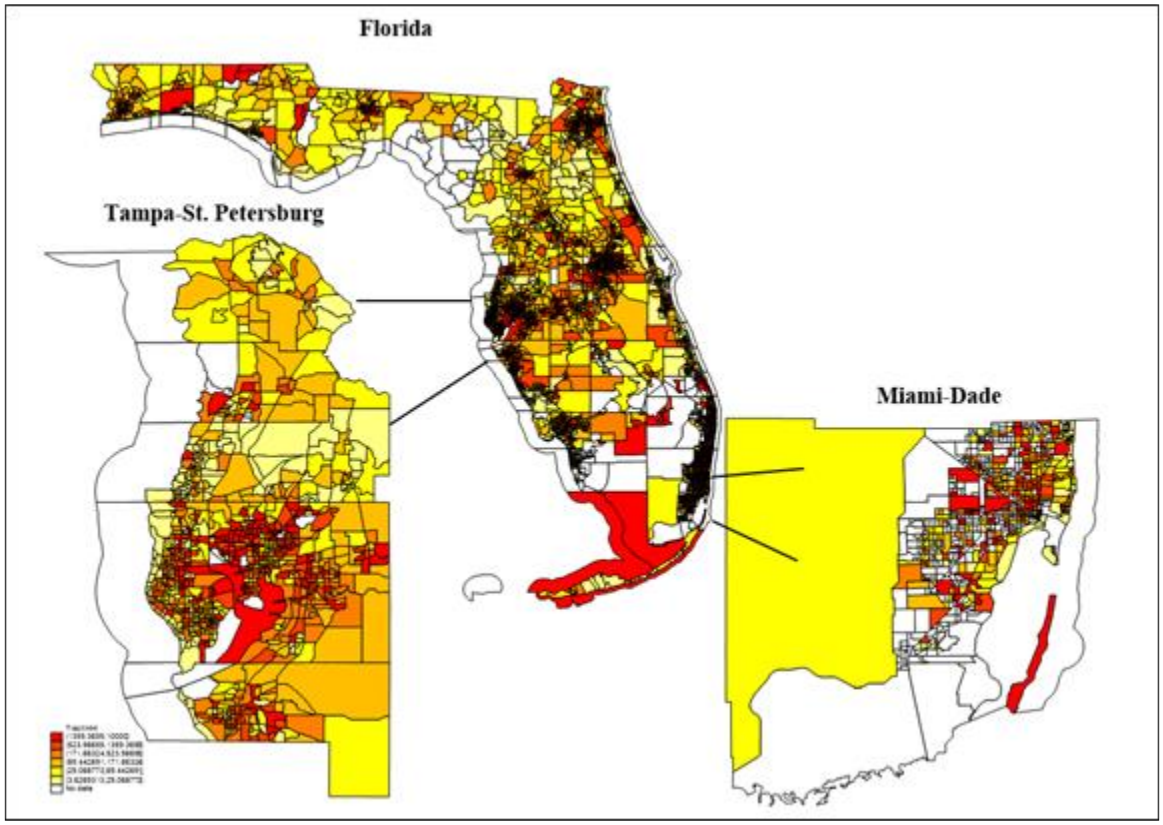
We use the Herfindahl Hirschman Index (HHI) among owners in a given Census Tract as the primary outcome variable of interest; this approach assumes that the Census Tract approximates the area over which renters perceive rental units to act as reasonably close economic substitutes (or in antitrust parlance, a relevant geographic market). Using property tax data from the Florida Department of Revenue, we calculated the individual market shares for owners of rental properties based on the number of units owned. We did this for two separate market distinctions: (1) All non-owner-occupied housing properties, and (2) all multifamily properties.[31] For each of these markets, we estimate the tract-level HHI by summing the squared unit market share values within the tract. Figure 1 presents a map of tract-level HHIs in 2022 based on unit shares of non-owner-occupied housing properties. Lower HHI areas are colored lighter yellow, while higher HHI areas appear in dark red. We lacked ownership data for those areas that appear whited out.

[29]. One might posit that potential management synergies flow from ownership of properties located in close proximity to each other. But our dependent variable is rent (or rental inflation), not margins. And if falling costs l resulting from agglomeration created synergies, the result would put *downward* pressure on rents. One might also argue that in an inflationary environment, it is reasonable to think that costs for rental accommodation will rise in the future, and that with sticky prices, independent firms would rationally raise their (nominal) prices. But outside of perhaps financing costs, the costs of providing accommodation are largely fixed, which means they should not enter the pricing calculus.

[30]. More specifically, we map clustering in Census Tract 12057013916, which is comprised of South Shore.

[31]. All non-owner-occupied housing properties consists of all multifamily properties, as well as all single-family homes and condominiums in which the owner's address was not equal to the physical property address within the property tax roll data.

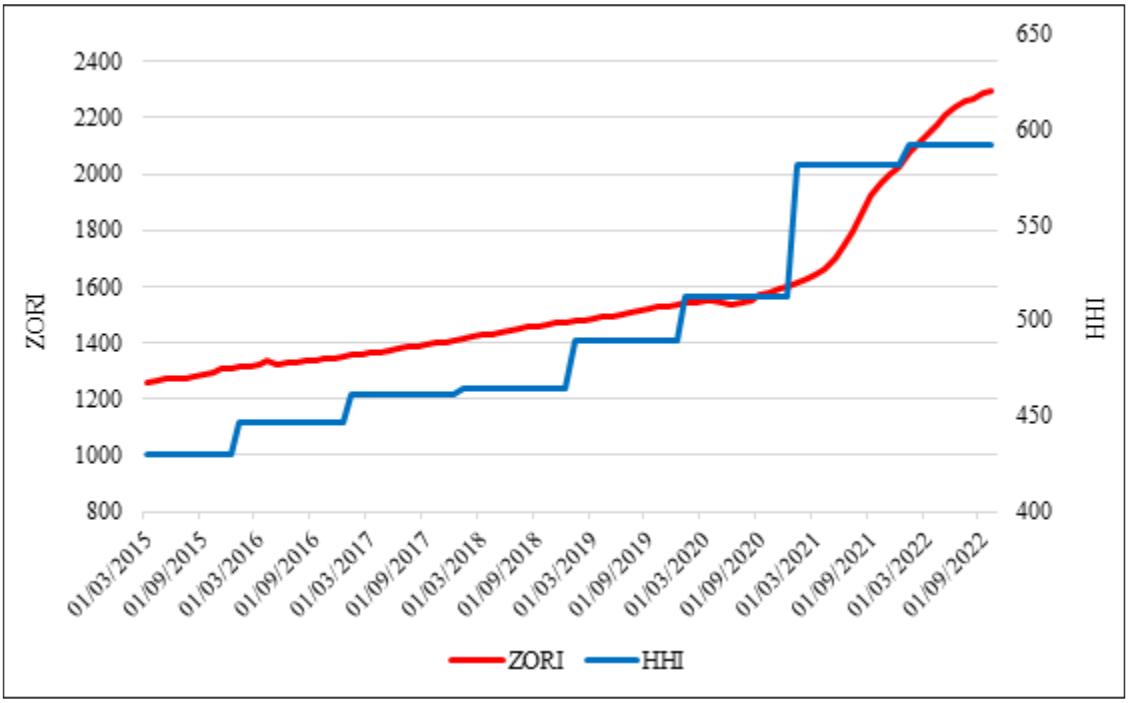
Figure 1. FLORIDA CENSUS TRACT HHI'S IN 2022



Source: 2022 Florida Property Tax Roll Data. HHI's are unit share based

For rents, we utilized the Zillow Observed Rent Index (ZORI), which indexes the mean of the middle 30% of asking rents by month. Figure 2 below plots the relationship between our measures of rents and rental ownership across time for all non-owner-occupied rental markets. Both rents and concentration levels have seen a steady uptick, with an increasing inflationary trend over the last two years.

Figure 2. FLORIDA MONTHLY AVERAGE ZORI AND HHI BY CENSUS TRACT (2015—2022)



Source: Zillow Observed Rent Index; Florida NAL Property Tax Rolls (2015—2022).

Before describing our model and data in greater detail, a brief digression on the use of concentration in a pricing model is in order. A substantial subset of the industrial organization (IO) literature has sought to discredit the use of concentration as an explanatory variable in econometric models that use prices or markups as the outcome variable. In the early 1970s, certain IO economists, such as Harold Demsetz, who taught at the University of Chicago Business School from 1963 to 1971, began muddling a long-held consensus that concentrated markets were amenable to the exercise of market power, insisting that the correlation between profits and concentration did not reflect oligopoly profits, but instead reflected costs advantages to superior firms that came to dominate an industry.[32] According to this revisionist camp, often associated with the post-WWII variant of the Chicago School of Economics, more concentrated markets are more competitive, because the most efficient firm gaining market share is evidence of competition, not its absence. Their technical "correction" to the regression of margins on concentration was to add a market share variable—itself highly correlated with concentration—and to claim that concentration was no longer positively related to margins once market share was controlled for.[33] If the concentration-profits relationship is caused by short-term rents earned by

[32].Harold Demsetz, *Industry Structure, Market Rivalry, and Public Policy*, 16(1) JOURNAL OF LAW AND ECONOMICS 1-10 (1973).

[33].Michael Salinger, *The Concentration-Margins Relationship Reconsidered*, BROOKINGS PAPERS: MICROECONOMICS 290 (1990), *available at* https://www.brookings.edu/wp-content/uploads/1990/01/1990_bpeamicro_salinger.pdf. Salinger refers to this questionable alteration as "extremely influential" in upsetting the structural presumption, with "F. M. Scherer and others consider[ing] the finding that market share rather than concentration determines firm profitability the most important result that has emerged from those data." *Id*. at 290. For a more recent treatment, see OECD, Methodologies to measure market competition, June 11, 2021 (explaining that concentration measures are highly sensitive to defining correct product and geographic markets, and have a stronger theoretical underpinning in homogenous markets),

superior firms with a cost advantage, the revisionists reasoned, then even concentrated markets can be viewed as competitive, and mergers do not facilitate collusion and higher prices.

This rewriting of the very meaning of concentration, and alleged technical defects (the "endogeneity" problem) in any regression of margins on concentration,[34] allowed the Chicago School to impose its ideological bent on the lens through which antitrust enforcement viewed harms to competition. The theory that concentration potentially reflected an efficiency that ostensibly reduced costs, which originated in the Chicago School, spread quickly into the mainstream of IO economics,. The benefits of cost reduction rested on the assumption that companies would pass along such savings to consumers in the form of lower prices rather than pocketing them to pad their margins. To this day, IO economists continue to push back against structural explanations for market conduct.[35]

Even critics of the use of concentration in pricing regressions acknowledge that econometric techniques can disentangle different causal effects.[36] For example, Whinston's 2008 treatise on antitrust economics explains endogeneity can complicate the effect of concentration, as profitability can determine the number of firms (and hence concentration) profitability and is thus correlated with a cost shock.[37] A researcher would need to find instruments, Whinston explains, correlated with HHI but not with the unobserved cost shock. Possible instruments identified by Whinston include market size and measures of

available at https://www.oecd.org/daf/competition/methodologies-to-measure-market-competition.htm.

[34].Detractors claimed that concentration was a flawed explanatory variable in a regression model because output decisions, which inform concentration, are a choice variable of the firm and thus are endogenous to the system: "If a large firm chooses a higher output than is predicted by the underlying (implicit) model, concentration will be higher and profits will be lower than expected. Thus output errors by large firms reduce the correlation between concentration and profitability. By the same line of reasoning, output errors by small firms increase the correlation between concentration and profitability." Salinger at 299-300. As Salinger notes, however, because the magnitude of errors of large firms with more discretion in output decisions likely exceed those of small firms, this alleged bias would tend to *reduce* the correlation between concentration and profit margins on net, making it harder to observe.

[35].*See, e.g*., Steven Berry, Martin Gaynor, and Fiona Scott Morton, *Do Increasing Markups Matter? Lessons from Empirical Industrial Organizations*, 33(3) JOURNAL OF ECONOMIC PERSPECTIVES 44–68, 46 (2019)("Within the field of industrial organization, the structure-conduct-performance approach has been discredited for a long time (Bresnahan 1989; Schmalensee 1989). But outside of industrial organization, the paradigm seems to have been readopted in recent years.").

[36].*See* Timothy Bresnahan, Empirical Studies of Industries with Market Power, Chap. 17 in 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 1011-57, at 1031 (Richard Schmalensee & Robert Willig eds., Elsevier 1989)("The next section treats the question of what constitutes an adequately rich specification of cost and demand so as to permit a reasonably convincing case that a strategic interaction hypothesis is in fact being tested. The section will show that the hypothesis of market power is in fact identified on reasonable data. ... *Only econometric problems*, not fundamental problems of interpretation, cloud this inference about what has been determined empirically.")(emphasis added)

[37].Whinston at 97.

the cost of entry.[38] Whinston concludes that "one might hope" regression of concentration on prices "gives at least approximately correct answers despite these problems."[39]

3. Data Set

To explore the relationship between concentration (the key independent variable) and rents or rental inflation (the dependent variables), we create a panel dataset for Florida rental properties. We use the Zillow Observed Rent Index (ZORI) as our dependent variable. This index measures "spot rents" that landlords charge to new tenants by leveraging Zillow's industry-leading database of rental properties.[40] ZORI data offer two key benefits. *First*, these data control for changes in the quality of rental units over time, allowing us to account for potential time varying omitted rental unit characteristics that affect price.[41] *Second*, ZORI provides data by ZIP code. Because we have concentration measures at the Census Tract level, we utilize HUD's Census Tract to USPS ZIP code quarterly crosswalk to map ZIP code rental indices to Tract indices, using the following formula:

$$Rent_{im} = \sum_{z=1}^{N} ResRat_{izq} * ZORI_{zm}$$

$Rent_{im}$ is our measure of the Weighted ZORI for Census Tract i in month m, $ResRat_{izq}$ is the residential ratio of ZIP code z in Census Tract i during quarter q, and $ZORI_{zm}$ is the Zillow Observed Rent Index for ZIP code z during month m.[42] The residential ratio provides the proportion of residential addresses within the Census Tract that reside within a ZIP code, allowing us to calculate a residential weighted rent index by Tract.[43]

[38].*Id.*

[39].*Id.* at 99.

[40].Zillow chooses not to publish the index for certain ZIP codes entirely or for some ZIP codes during certain months. This can be due to uncertainty about the quality of the data, or for any other reason it so chooses. *See* Aiqi Sun and Yuan Yuan, *Changes in the Zip-code Level Rent Distribution under COVID-19 and the Bid-rent Theory*, UNC CHAPEL HILL 7-8 (Sept. 2021).

[41].Joshua Clark, *Methodology: Zillow Observed Rent Index (ZORI)*, ZILLOW (Sept. 19, 2022), *available at* https://www.zillow.com/research/methodology-zori-repeat-rent-27092/. ZORI controls for quality changes over time using the "repeat sales regression" model introduced by Bailey et. al (1963), which was later refined by Case and Shiller (1980) and Ambrose et. al (2015). Martin J. Bailey, Richard F. Muth, and Hugh O. Nourse, *A Regression Method for Real Estate Price Index Construction*, 58(304) JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION 933-942 (1963); Karl E. Case and Robert J. Shiller, *The Efficiency of the Market for Single-Family Homes*, 79(1) THE AMERICAN ECONOMIC REVIEW 125-137 (1989); Brent W. Ambrose, N. Edward Coulson, and Jiro Yoshida, *The Repeat Rent Index*, 97(5) THE REVIEW OF ECONOMICS AND STATISTICS 939-950 (2015).

[42].Tract-ZIP crosswalk data is provided quarterly through Q4 2021. We use Q4 2021 crosswalk data for 2022. HUD, *HUD USPS ZIP Code Crosswalk Files*, TRACT-ZIP, *available at* https://www.huduser.gov/portal/datasets/usps_crosswalk.html.

[43].For example, the tract 12057002800 within Tampa, FL, is comprised of two ZIP codes—33602 and 33603. These two ZIP codes have residential ratios equal to 0.324 and 0.676, respectively. In August 2022, The Zillow Observed Rent Index value for ZIP 33602 was 2,841 and for ZIP 33603 was 2,004. The weighted rent index is therefore (0.324 * 2,841) + (0.676 * 2,004) = 2,275. If a given

We rely on Real Property Tax Roll data from the Florida Department of Revenue to estimate rental market HHIs.[44] We obtained annual, county-level data from 2015–2022. Each property observation contains its use code, number of units, address, Census block, and owner name and owner address information. The Census block identifier allows us to assign each property to a Census tract, and to then calculate an owner's market share within that tract based on the sum of their total units across all properties.[45] We calculate tract-level market shares based on two market delineations. The first only accounts for multifamily properties, including multifamily properties with less than 10 units.[46] The second includes all multifamily properties as well as any single-family home or condominium in which the owner's address is not the property address, under the assumption that this is a rental property. We exclude properties that have a missing owner or Census tract. A tract's rental HHI equals the sum of the unit shares across all rental owners within the tract by market.

We include county-level time varying controls which could also affect rents. First, we incorporate annual county net migration data from the Census in order to account for changes in rental demand due to population movements.[47] Second, we use the average weekly wage by quarter from the BLS Quarterly Census of Employment and Wages (QCEW) in order to control for changes to income and productivity. Finally, we use employment by month from QCEW to adjust for changes to labor supply.[48] Table 1 presents the summary statistics.

tract has a missing ZORI value for one of its ZIP codes, we assign the ZIP code with the largest initial residential ratio to the entire tract.

[44]. The most recent 2022 data is available at https://floridarevenue.com/property/Pages/DataPortal_RequestAssessmentRollGISData.aspx. Additionally, we requested and obtained data for the years 2015 – 2021 from the Property Tax Oversight section of the Florida Department of Revenue.

[45]. We treat the owner's name field as the unique owner identifier.

[46]. Florida NAL data distinguishes between residential and commercial multifamily properties. Multifamily properties with greater than 10 units is classified as commercial, while those with 10 units or less are classified as residential. For our purposes, we can treat these both as "rental properties."

[47]. Migration data goes through 2021. We extrapolate 2022 net migration by county based on the growth rate in estimated population from year 2021 to 2022. 2022 population estimates come from World Population Review's *Population of Counties in Florida (2022), available at* https://worldpopulationreview.com/us-counties/states/fl.

[48]. QCEW data goes through Q1 2022. We extrapolate wages and employment forward to October 2022 by regressing on interaction dummies of the year-month and county. When excluding the year 2022 from our regressions, the coefficient on log HHI remains positive and statistically significant across both models (log rent and inflation) for all tract fixed effects regressions, including OLS and both IV specifications (columns 2, 4, and 6 of Tables 2 and 3 below).

Table 1. SUMMARY STATISTICS

	Mean	SD	Minimum	Maximum	N
Tract ZORI	1,592	550	579	9,318	194,091
%? ZORI	0.09	0.11	-0.45	4.10	194,091
Tract HHI	537	959	2	10,000	194,091
Average Units Per Property (IV)	3	15	1	441	194,091
Average Neighbor Tract HHI (IV)	553	248	6	2,920	194,091
County Net Migration	7,044	12,422	-30,592	26,856	194,091
%? County Net Migration	0.13	1.73	-8.61	8.63	194,091
County Average Wage by Quarter	1,021	158	604	1,545	194,091
%? County Average Wage by Quarter	0.05	0.04	-0.18	0.19	194,091
County Employment by Month	565,990	341,148	2,495	1,189,201	194,091
%? County Employment by Month	0.02	0.04	-0.22	0.25	194,091
Total Property Records					28,562,749
Total Census Tracts					3,524

Note: Data spans March 2015–October 2022.

4. The Model

To identify the relationship between concentration and rents, we specify the following regression model:

$$\ln\left(\text{Rent}_{ct,m}\right) = \alpha + \beta_1 \ln\left(\text{HHI}_{ct,y}\right) + \beta_2 \ln\left(\text{Migr}_{c,y}\right) + \beta_3 \ln\left(\text{Wages}_{c,q}\right) + \beta_4 \ln(\text{Emp}_{c,m}) + \gamma_{ct} + \varepsilon_{ct,m}$$

$\text{Rent}_{ct,m}$ is the tract-level Zillow Observed Rent Index for Census tract *ct* during the month *m*. $\text{HHI}_{ct,y}$ is the annual Herfindahl-Hirschman Index for tract *ct* during year *y* and represents the treatment variable of interest. $\text{Migr}_{c,y}$ is the annual net migration into the county *c* that tract *ct* resides in.[49] $\text{Wages}_{c,q}$ is the average weekly wage for county *c* in quarter *q*. $\text{Emp}_{c,m}$ is the monthly employment level for county *c*. Additionally, we control for unobserved time invariant factors that vary by tract through our use of tract fixed effects γ_i.

Our base model relates changes in concentration to changes in the level of rents, which is an indirect measure of rental inflation. To examine the relationship between rental inflation and concentration directly, we generate a second model in which the dependent variable is the percentage change in the rental index in a given Census Tract over the prior twelve months. Concentration continues to enter the regression in levels, but the other control variables enter this model as annual percentage changes as well:

$$\%\Delta\ \text{Rent}_{ct,m} = \sigma + \theta_1 \ln\left(\text{HHI}_{ct,y}\right) + \theta_2 \%\Delta\ \text{Migr}_{c,y} + \theta_3 \%\Delta\ \text{Wages}_{c,q} + \theta_4 \%\Delta\ \text{Emp}_{c,m} + \gamma_{ct} + \varepsilon_{ct,m}$$

The St. Louis Fed's study posited that the OLS coefficient of investors' market share explaining housing price growth could be biased downwards to the extent that investors were attracted to areas where prices collapsed following the crisis.[50] A similar phenomenon could occur here, to the extent that prior rental inflation influences investors' decision of

[49]. Since net migration can be negative, we subtract its minimum value and add 1 before applying the natural log.

[50].*St. Louis Fed Study* at 2.

where to invest or how to agglomerate properties. Economists typically resolve such issues, if they exist, by identifying a good instrument for the potentially endogenous variable.[51]

To address the potential endogeneity problem of institutional owners' share of properties in a given MSA, the St. Louis Fed Study's researchers used as an instrument the local exposure to quantitative easing (QE) that channels investment into the housing markets. The authors measured this instrument for investors' market share as the share of the top earners' business income over total income in each MSA in 2007.[52] The study finds that the share of the top earners' business income is uncorrelated with factors that determine house prices.[53]

While the St. Louis Fed Study was able to rely on QE as a relevant instrument for their panel, it could present issues for our purposes. First, while the QE instrument may correlate with institutional investment, it may not do so with concentration. Second, by the time that our panel begins (in 2015), we would expect those areas affected by QE to already have absorbed its effects. Even if QE did result in greater concentration in certain areas, these effects would be differenced out by our use of tract level fixed effects.

We instead employ two separate instruments. We first use the average annual number of units per property within a given Census tract, positing that building density correlates with rent changes. Generally, we would expect that areas with a greater number of average units per property are more likely to be concentrated due to higher barriers of entry. Given the highly capital-intensive nature of real estate development, a larger, well-capitalized property developer could finance the purchase of a large multifamily apartment property more readily than an individual who purchases a single-family home as a rental investment. At the same time, we believe that our use of tract-level fixed effects allows us to treat this instrument as an exogenous shifter of HHIs. While tracts with a greater average number of units per property are also likely to be in more urban areas, providing them with a rental premium, we believe that our controls for migration, wages, and tract fixed effects parse out any associated endogeneity issue related to this.

Furthermore, we introduce a variant of the "Hausman instrument" that is commonly used throughout the industrial organization literature.[54] For a given Census tract, we instrument its HHI by the average HHI across all other neighboring Census tracts within the same county, *excluding* the tract's HHI itself. We reason that concentration across tracts within a larger region are likely to be correlated with each other, but the average countywide ownership concentration is unlikely to be endogenous to changes in rents within a specific tract. As shown in our results below, all first-stage F-statistics far exceed the common rule-of-thumb of 10, suggesting that our instruments are sufficiently strong across both models.[55]

[51].A good instrument is correlated with the endogenous regressor (investors' market share) for reasons the researcher can verify and explain, but uncorrelated with the outcome variable for reasons beyond its effect on the endogenous regressor.

[52].*Id.* at 3.

[53].*Id.*

[54].Jerry Hausman, Gregory Leonard, and J. Douglas Zona, *Competitive Analysis with Differentiated Products*, 34 ANNALES D'ECONOMIE ET DE STATISTIQUE 159–180 (1994).

[55]. Douglas Staiger and James H. Stock, *Instrumental Variables Regression with Weak Instruments*, 65(3) ECONOMETRICA 557-586 (1997).

5. Results

We provide results for our preferred market definition, all non-owner-occupied rental properties, in Tables 2 and 3 below. Appendix Tables A2 and A3 provide results when using only multifamily properties to compute tract-level HHIs. For both market delineations, we calculate positive and statistically significant effects of concentration levels on rent levels and rental inflation rates.

Table 2 provides our log rent model results using both OLS and IV models. Column 1 only controls for migration, wages, and the employment level. Column 2 adds tract-level fixed effects. The coefficient on ln(HHI) implies that a one percent increase in rental market concentration results in an economically and statistically significant increase in rents. To control for endogeneity concerns, we present IV results in Columns 3-6. Columns 3 and 5 present the first-stage regression results when regressing our independent variable of interest, ln(HHI), on each of our two exogenous instruments. Column 3 uses the log of the average annual unit count per property to instrument for concentration, while Column 5 uses the average HHI across all other neighboring tracts within a county, excluding the tract itself. Both first-stage regressions have F-statistics far greater than 10, suggesting that the instruments are relevant. Columns 4 and 6 provide second-stage regression results, which are our best estimates as to the causal impact of concentration on rents. Both show a positive and statistically significant relationship between rental market concentration and rents, suggesting that a 1% increase in HHI results in a 0.03-0.06% increase in rents, holding all else equal. This is economically significant, especially given that the average HHI is below 1,000. For example, suppose the HHI in a given tract is equal to 600 and that the average rent is $1,500. If the HHI doubles to 1,200, the average rent increases to $1,545-$1,590. If the HHI increases to 2,400, the average rent would increase to $1,590-$1,680.

Table 2. OLS AND IV REGRESSIONS OF LOG RENT ON LOG HHI

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	**OLS**	**IV**		**IV**	
			1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*
	ln(ZORI)	ln(ZORI)	ln(HHI)	ln(ZORI)	ln(HHI)	ln(ZORI)
ln(HHI)	-0.0343	0.0113		0.0228		0.0639
	(<0.001)	(<0.001)		(<0.001)		(<0.001)
ln(Avg Unit Count)			1.568			
			(<0.001)			
ln(Neighbor Tract HHI)					0.274	
					(<0.001)	
ln(Migration)	-0.0156	0.00227	-0.00179	0.00233	-0.00379	0.00251
	(<0.001)	(<0.001)	(0.007)	(<0.001)	(<0.001)	(<0.001)
ln(Wage)	1.223	1.162	0.487	1.152	0.630	1.119
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
ln(Employment)	-0.0499	0.618	0.311	0.614	0.222	0.598
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Constant	-0.157	-8.800	-3.056	-8.738	-3.876	-8.516
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Tract FE	N	Y	Y	Y	Y	Y
# of Tract FE		3,524	3,523	3,523	3,524	3,524
Observations	194,091	194,091	193,976	193,976	194,091	194,091
F-Statistic	25,414	80,619	2,637	79,961	2,715	80,844
R-Squared	0.354	0.917	0.960	0.917	0.949	0.917

Note: p-values in parentheses. Standard errors are robust. The 2nd Stage R-squared values displayed in columns (4) and (6) are estimated by regressing ln(ZORI) on the predicted values of ln(HHI) from columns (3) and (5).

Next, we study the effect of concentration on rental *inflation* (as opposed to the levels of rents studied above). Table 3 provides results of our rental inflation model using the same OLS and IV estimation strategies. Columns 1 and 2 provide estimates of the correlation between log HHIs and rental inflation rates, as measured by the 12-month percentage change in the ZORI. Columns 3 and 4 show the first and second-stage results when using average property unit count as an instrument. Columns 5 and 6 show these results when using the Hausman instrument. Columns 4 and 6 both provide evidence that Census tracts with higher levels of rental concentration, as measured by the HHI, tend to experience higher rates of rental inflation.

Table 3. OLS AND IV REGRESSIONS OF RENTAL INFLATION ON LOG HHI

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	**OLS**	**IV**		**IV**	
			1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*
	%? ZORI	%? ZORI	ln(HHI)	%? ZORI	ln(HHI)	%? ZORI
ln(HHI)	0.000232	0.0217		0.0464		0.113
	(0.160)	(<0.001)		(<0.001)		(<0.001)
ln(Avg Unit Count)			1.576			
			(<0.001)			
ln(Neighbor Tract HHI)					0.304	
					(<0.001)	
%? Migration	0.00687	0.00610	0.0101	0.00583	0.0113	0.00479
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
%? Wage	0.698	0.681	0.464	0.662	0.620	0.609
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
%? Employment	0.674	0.683	-0.235	0.689	-0.214	0.705
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Constant	0.0432	-0.0647	4.322	-0.189	3.121	-0.526
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Tract FE	N	Y	Y	Y	Y	Y
# of Tract FE		3,230	3,518	2,487	3,519	2,488
Observations	156,250	156,250	175,435	156,148	175,550	156,250
F-Statistic	6,805	6,836	806	6,588	1,071	6,699
R-sq	0.184	0.280	0.963	0.279	0.952	0.282

Note: p-values in parentheses. Standard errors are robust. The 2nd Stage R-squared values displayed in columns (4) and (6) are estimated by regressing ln(ZORI) on the predicted values of ln(HHI) from columns (3) and (5).

6. Policy Implications

These findings support the hypothesis that concentration is contributing to higher rental prices and higher rental inflation. The precise mechanism by which this is occurring is not uncovered by our model. We are not aware, for example, of any of the institutional owners in Florida using earnings calls to announce for future rental increases. There is a lawsuit alleging a price-fixing conspiracy among property managers using a common pricing algorithm, following on the heels of an investigation in *ProPublica*.[56] In the absence of an

[56].Heather Vogell, *Company That Makes Rent-Setting Software for Apartments Accused of Collusion, Lawsuit Says*, PROPUBLICA, Oct. 21, 2022**,** *available at* https://www.propublica.org/article/realpage-accused-of-collusion-in-new-lawsuit. Heather Vogell, Rent's Going Up? One Company's Algorithm Could Be Why, ProPublica, Oct. 15, 2022, *available at* https://www.propublica.org/article/yieldstar-rent-increase-realpage-rent ("RealPage became the nation's dominant provider of such rent-setting software after federal regulators approved a controversial merger in 2017, a ProPublica investigation found, greatly expanding the company's

explicit agreement, concentration among institutional owners would facilitate coordinated rental increases, which might be easier to achieve during times of generalized inflation.

Perhaps the result of the inculcation of macroeconomic dogma that has prevailed hitherto, many economists have latched on to the premise that raising interest rates serves as the Federal Reserve's panacea for combating inflation of all sorts, including rental inflation. A vocal minority have resisted this urge, advocating for the consideration of a broader set of interventions beyond interest rate hikes to target inflation in a specific economic sector. Some of us have pointed out that, by raising interest rates, the Fed perversely steers demand away from single-family home ownership (depressing home prices) and towards multi-family rental properties (increasing rental prices)—exacerbating rather than countervailing inflation.

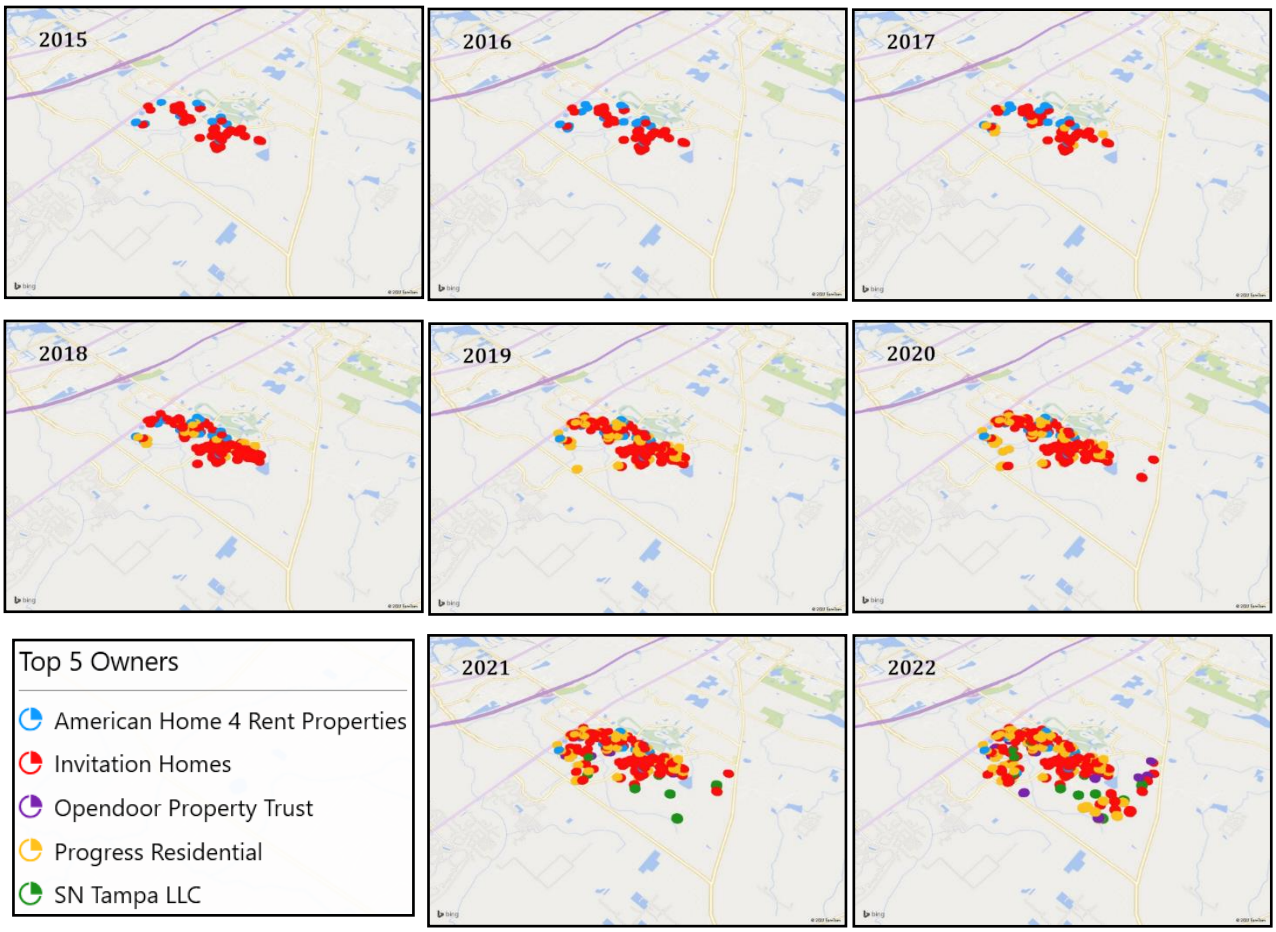
The results from our regressions imply that legislative bodies, at either the state or federal level, could impose limitations on the extent of ownership by a single institutional investor within a given Census Tract. For example, a state such as Florida could pass a law limiting ownership for a single institution to no more than five percent of properties in a given Census Tract. Before the mandatory divestitures occur, rents set by institutional investors could be subjected to rent control.

Given that concentration is shown not only to increase rents, but also the *rate* of rental increases, our findings imply that inflation can be exacerbated by competition problems. As such, promoting competition broadly could have the effect of lowering inflation. The question of course will be speed. Direct intervention via antitrust enforcement is one option, though due process and the rule of law might undermines such efforts in the short run. Many countries have market investigation regimes for this purpose, including UK and now proposed for Germany, where such an intervention could come from the competition authority. Clearly, this could not happen overnight, which is a counter argument for competition policy as a short-run tool, but a good one for stronger antitrust enforcement over time.

influence over apartment prices. The move helped the Texas-based company push the client base for its array of real estate tech services past 31,700 customers.").

Appendix 1

Clustering Maps in the South Shore Neighborhood of Riverview, FL, 2015-2022



Appendix 2

Summary Statistics and Regression Results for Only Multifamily Properties

As described in our Data section, we delineate between all non-owner-occupied rental properties, as well as only multifamily properties. Here, we provide results when limiting the market to solely multifamily properties. Table A1 provides summary statistics. Table A2 provides results for our log-level regressions. Table A3 provides results for our rental inflation regressions. As in our Results section, column 1 provides OLS estimates with no tract fixed effects. Column 2 incorporates tract fixed. Columns 3 and 4 provide the first and second stage results when using the average number of units per property within a tract as an instrument for the HHI. Columns 5 and 6 provide the first and second stage results when using the average HHI of all neighboring tracts within a county, excluding the tract itself.

Similar to our results when using all rental properties, the coefficient for ln(HHI) in both the log-rent and inflation model is both positive and statistically significant.

Table 4. SUMMARY STATISTICS (ONLY MULTIFAMILY)

	Mean	SD	Minimum	Maximum	N
Tract ZORI	1,557	519	579	9,318	167,196
%? ZORI	0.09	0.10	-0.45	2.70	167,196
Tract HHI	3,354	3,168	30	10,000	167,196
Average Units Per Property (IV)	60	103	1	1,912	167,196
Average Neighbor Tract HHI (IV)	3,442	750	866	6,794	167,196
County Net Migration	7,010	12,358	-30,592	26,856	167,196
%? County Net Migration	0.11	1.73	-8.61	8.63	167,196
County Average Wage by Quarter	1,019	156	604	1,545	167,196
%? County Average Wage by Quarter	0.05	0.04	-0.18	0.19	167,196
County Employment by Month	560,412	339,538	2,495	1,189,201	167,196
%? County Employment by Month	0.02	0.04	-0.22	0.25	167,196
Total Property Records					1,336,223
Total Census Tracts					3,044

Note: Data spans March 2015–October 2022.

Table 5. OLS AND IV REGRESSIONS OF LOG RENT ON LOG HHI (ONLY MULTIFAMILY)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	**OLS**	**IV**		**IV**	
			1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*
	ln(ZORI)	ln(ZORI)	ln(HHI)	ln(ZORI)	ln(HHI)	ln(ZORI)
ln(HHI)	-0.00999	0.00711		0.0404		0.286
	(<0.001)	(<0.001)		(<0.001)		(<0.001)
ln(Avg Unit Count)			0.219			
			(<0.001)			
ln(Neighbor Tract HHI)					0.574	
					(<0.001)	
ln(Migration)	-0.0188	0.00199	-0.000593	0.00201	-0.00164	0.00210
	(<0.001)	(<0.001)	(0.112)	(<0.001)	(<0.001)	(<0.001)
ln(Wage)	1.165	1.173	0.0456	1.169	0.0360	1.142
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
ln(Employment)	-0.0544	0.631	-0.0606	0.632	-0.107	0.639
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Constant	0.218	-9.049	7.373	-9.290	3.973	-11.02
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Tract FE	N	Y	Y	Y	Y	Y
# of Tract FE		3,044	3,043	3,043	3,044	3,044
Observations	167,196	167,196	167,112	167,112	167,196	167,196
F-Statistic	19,675	70,161	479	70,206	411	70,776
R-Squared	0.310	0.916	0.975	0.92	0.974	0.92

Note: p-values in parentheses. Standard errors are robust. The 2nd Stage R-squared values displayed in columns (4) and (6) are estimated by regressing ln(ZORI) on the predicted values of ln(HHI) from columns (3) and (5).

Table 6. OLS AND IV REGRESSIONS OF RENTAL INFLATION ON LOG HHI (ONLY MULTIFAMILY)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	**OLS**	**IV**		**IV**	
			1st Stage	*2nd Stage*	*1st Stage*	*2nd Stage*
	%? ZORI	%? ZORI	ln(HHI)	%? ZORI	ln(HHI)	%? ZORI
ln(HHI)	-0.00120	0.00831		0.0664		0.391
	(<0.001)	(<0.001)		(<0.001)		(<0.001)
ln(Avg Unit Count)			0.230			
			(<0.001)			
ln(Neighbor Tract HHI)					0.607	
					(<0.001)	
%? Migration	0.00689	0.00640	0.000636	0.00628	-0.00156	0.00550
	(<0.001)	(<0.001)	(0.051)	(<0.001)	(<0.001)	(<0.001)
%? Wage	0.688	0.682	0.0554	0.674	0.0687	0.630
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
%? Employment	0.669	0.670	-0.0299	0.671	-0.0647	0.683
	(<0.001)	(<0.001)	(0.022)	(<0.001)	(<0.001)	(<0.001)
Constant	0.0539	-0.0171	6.865	-0.451	2.553	-2.881
	(<0.001)	(0.061)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Tract FE	N	Y	Y	Y	Y	Y
# of Tract FE		2,163	3,037	2,162	3,038	2,163
Observations	134,922	134,922	151,256	134,838	151,340	134,922
F-Statistic	6,039	5,879	439	5,964	348	6,415
R-sq	0.210	0.299	0.977	0.301	0.976	0.315

Note: p-values in parentheses. Standard errors are robust. The 2nd Stage R-squared values displayed in columns (4) and (6) are estimated by regressing ln(ZORI) on the predicted values of ln(HHI) from columns (3) and (5).