

Investigation of Alleged 'Algorithmic Collusion' in Rental Housing

Impact and Implications of
RealPage's Pricing Algorithms for
Housing Affordability

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1. **Background**
2. Data Collection and Preparation
3. Modeling Realpage & Rent Levels
4. Interactive Website
5. Causal Inference Methods
6. Conclusion

Research Background

Reports and Lawsuits Draw National Attention

- ProPublica Report Spotlights Potential Issue (2022)
- Lawsuits follow within days
- Biden-Harris CEA Estimates 4% Rent Uplift (but assumes collusion)
- RealPage Rebuts Arguments & Discloses Nationwide Rent Data

Background

Technology

Rent Going Up? One Company's Algorithm Could Be Why.

by Heather Vogell, ProPublica, with data analysis by Haru Coryne, ProPublica, and Ryan Little

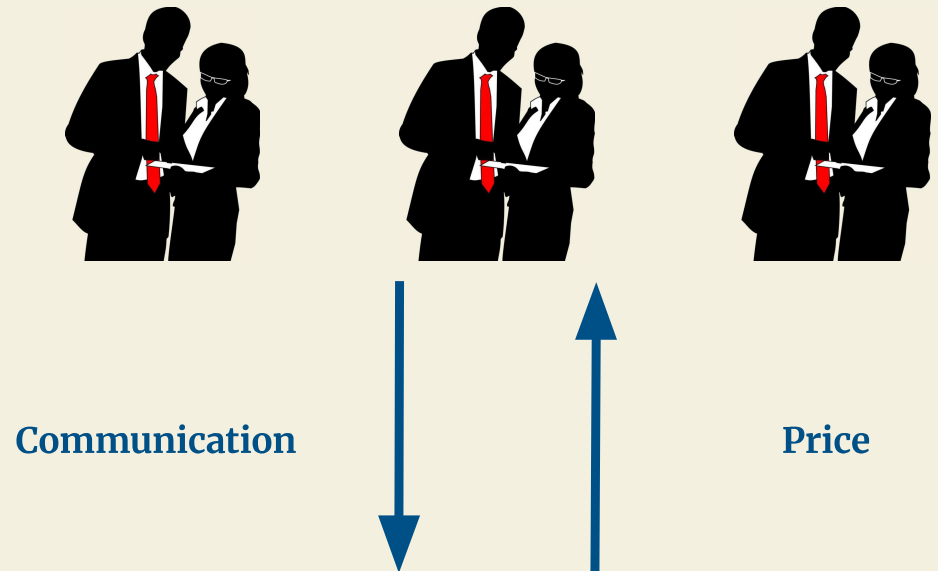
Oct. 15, 2022, 5 a.m. EDT

Animation by Lisa Larson-Walker/ProPublica

Theory of Harm

- Housing Affordability is a Growing Crisis
- Landlords are increasingly using RealPage's Pricing Algorithms
- Using clients' data to train for other clients may be collusion
- Pricing Algorithms can 'learn' collusive behavior independently
(see, e.g., Calvano, E., et al. (2020); Asker, J., et al. (2022))

Background



 **REALPAGE®**

Key Questions

Rent Impact

Does RealPage usage
predict higher rent in
public data?

If so, by how much?

Causal Inference

Is the rent impact we
observe caused by
price-coordination?

Is there statistical
evidence to show this?

Communication

What's the best way to
show this information?

How can renters and
policymakers learn
about the rent impact?

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Tech Talk: Data Acquisition

RealPage

Scraped 42,000 properties from RealPage

Washington
Post

Pulled Estimated Market Share; Clients

Property
Managers

Scraped Properties from WaPo Named Clients

Zillow,
HUD

Accessed Metro-Level Rent Indices

Census

Accessed Additional Metro-Level Data from Census

Data Tech Talk: 2025 Properties Snapshot

Matched Addresses on RealPage Explore (~42,000) with Addresses from Clients Named in Lawsuits (41 clients, 9,000 Properties, 5,173 Matched).

Utilized Open Source Maps & Fuzzy Matching

Data includes covariates such as:

- Year Built
- Market & Submarket
- Average Square Foot
- Average Rent & Rent Per Square Foot
- ... And more



Data Tech Talk: Zillow Rent Index

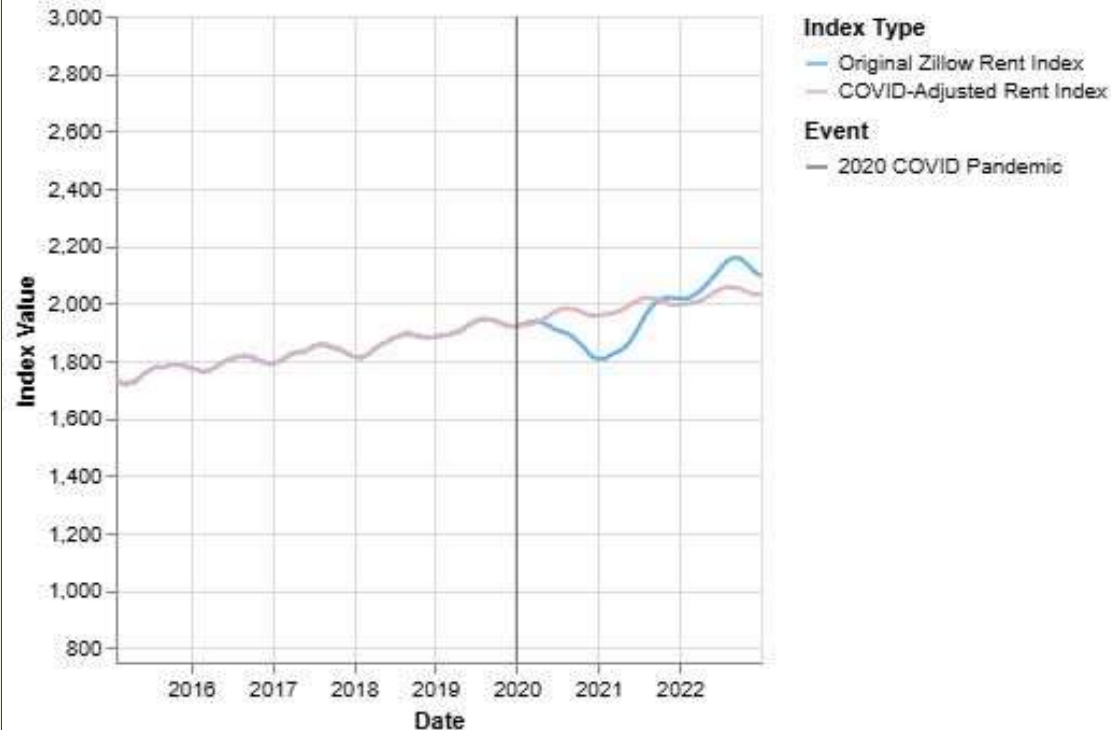
Accessed Zillow panel data with the
observed multifamily rent index.

Time: 2015 to Present

Geography: Metropolitan Statistical Areas
(MSAs)

Utilized ARIMA forecasting to estimate a
post-2020 counterfactual without COVID;
necessary for our 2017 Merger Analysis.

Zillow Index and COVID Adjustment
2015 - 2022



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Model 1: Propensity Model

Why Propensity?

- Differed systematically in observable characteristics (size, age, occupancy).
- Can bias any direct rent comparisons

Covariates Used to Predict RealPage Usage

Feature	Rationale
Square Footage	Larger, more modern buildings use RealPage
Stories	Vertical scale linked to RealPage use
Unit Count	Larger complexes often adopt RealPage and pricing algos
Building Age	Newer buildings charge more, often use RealPage
Occupancy Rate	Reflects demand/supply dynamics and pricing behavior
CBSA (One-Hot)	Controls for regional effects without linear assumptions

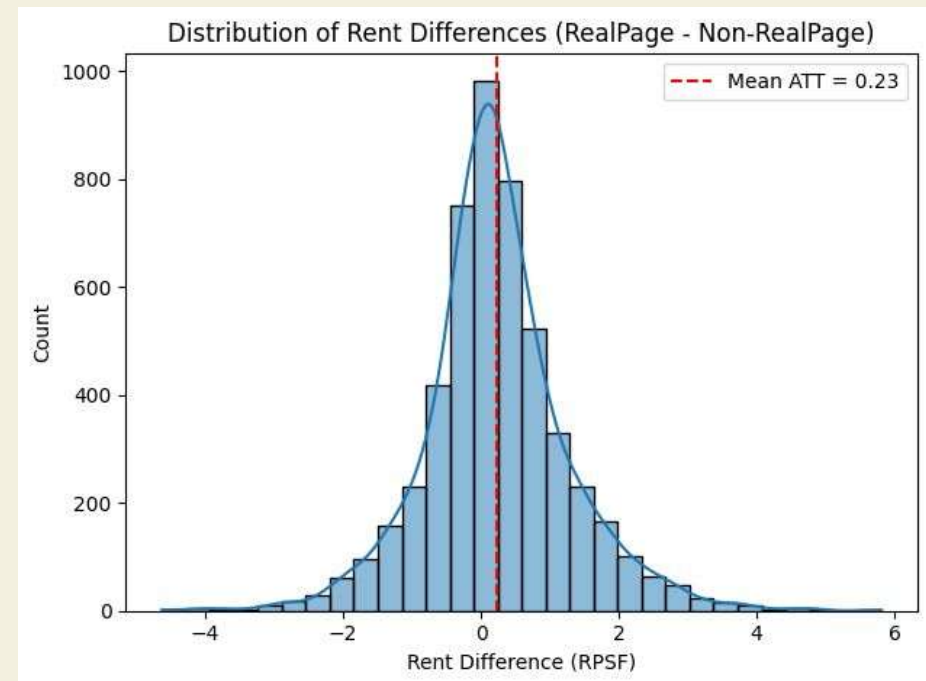
Model 1: Propensity Model Results

Matching Summary

- 1:1 Nearest Neighbor Matching without replacement
- 5,089 RealPage users matched to similar non-users
- All covariates achieved standardized mean difference < 0.1 post-match

Outcome Analysis

- Outcome Variable: MPF – RPSF (Rent per Square Foot)
- Average Treatment Effect on the Treated (ATT):
+ \$0.23 increase in RPSF for RealPage properties



Additional Modeling: Predict RSPF

Model	Mean Squared Error (MSE)	R ² Score	Description
Model 3 (Baseline RF)	0.04040	0.9214	Random Forest baseline using features including market_share
Gradient Boosting	0.06	0.89	Ensemble method that captures non-linear relationships. Feature importance shows market_share as influential.
Feed Forward Neural Network	0.03836	0.9254	Feed-forward NN with 3 hidden layers (64, 32, 16 neurons). Uses ReLU activations and early stopping; learns complex interactions with market_share.

Additional Modeling: Let's Simulate!

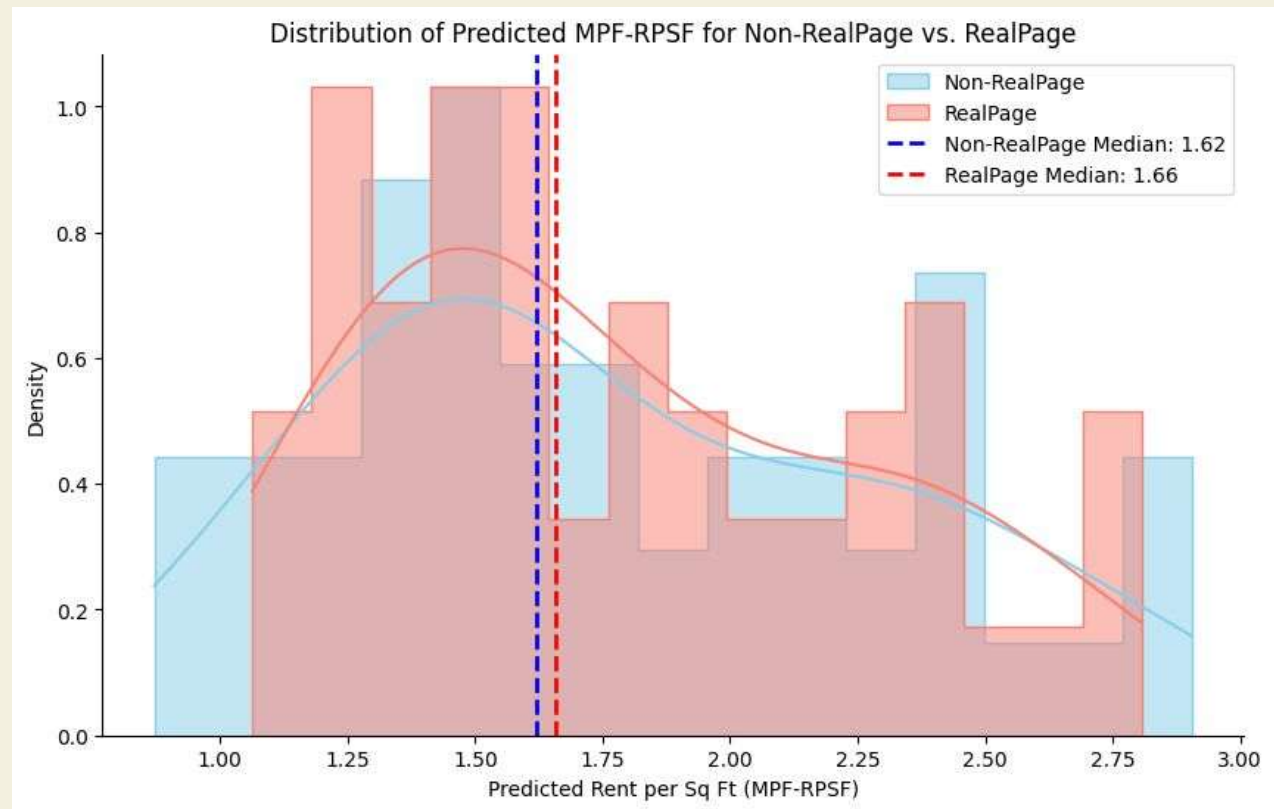
One sided Mann-Whitney U test:

Predictions made using the FFNN

Number of samples: 50

P-Value: 0.4465

Not statistically
significant



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Communicate with Interested Users

UC Berkeley
School of
Information
MIDS Capstone:
RealPage Rent Impact
Dashboard

Homepage

About

Data Dictionary

Interactive Map

Key Findings

Try It Yourself: Interactive
Modeling

Contact Us

View Research
Paper

Is Algorithmic Pricing Raising Your Rent?

A Data-Driven Investigation

RealPage's software lets landlords share secret pricing data, coordinating rent hikes instead of competing for tenants. The result? **Higher rents, fewer concessions**, and no real choice for renters.

Landlords aren't setting prices—an algorithm is. RealPage collects and analyzes private rent data from competitors, then recommends price hikes landlords follow almost automatically. This isn't competition—it's algorithmic price-fixing.

This isn't just bad for renters—it's bad for the market. **RealPage controls 80% of the apartment pricing software industry**, creating a monopoly that locks landlords in and locks renters out of fair pricing.

When landlords collude, **renters lose**. Lawsuits are underway, but millions of renters have already paid the price. Housing should be a competitive market—not a rigged game.

\$1,803

DC's Fair Market Rent (1
Bedroom Apartment, \$2,045
for 2 bedrooms)

\$2,053

DC's Average Rent (All
Apartments)

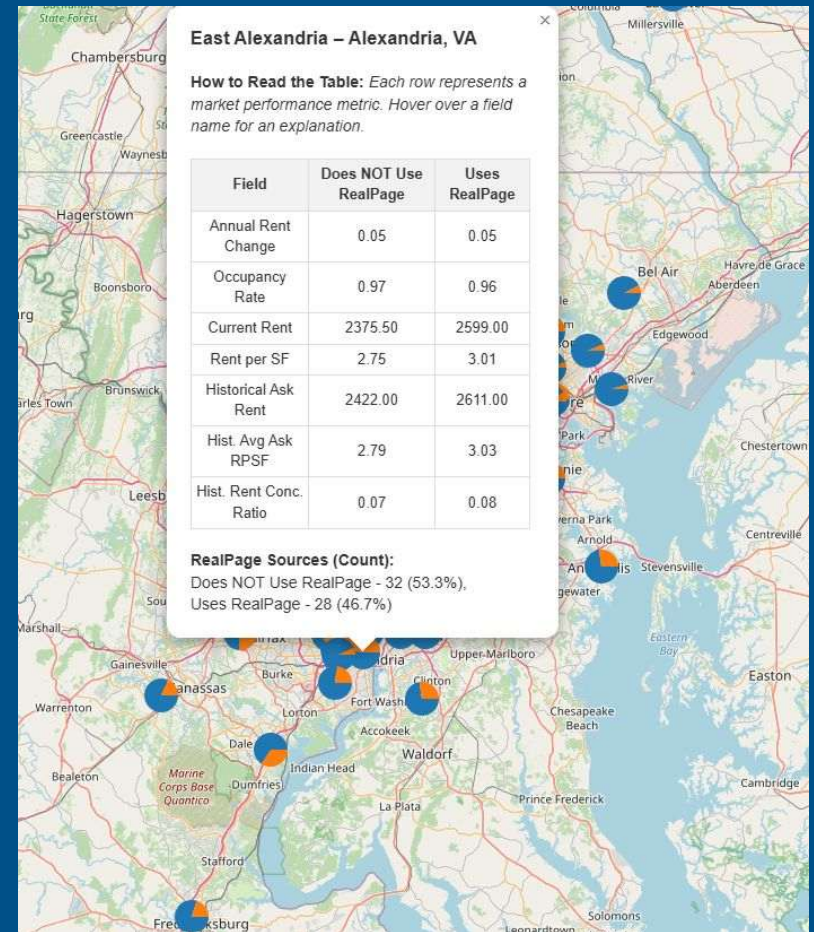
\$2,150

RealPages's Average Rent
(DC, All Apartments)

Jump to Key Findings

Interactive National Map

- Renters and policymakers can explore nationwide
- Uses snapshot of ~42,000 properties
- Quickly see estimate of Named Clients by submarket
- Drill deeper to see average differences in rent levels and property characteristics by submarket



‘Try It Yourself:’ Test Our Model

- Users can interact with model inputs directly
- Customize input with property details:
 - RealPage Usage
 - Year Built
 - Number of Stories
 - Submarket
 - Etc.
- Receive prediction of expected rent level

Try It Yourself: Interactive Modeling

Use the input fields below to provide the model inputs. The model will analyze your inputs to predict outcomes on RealPage's potential impact in pricing. After submission, you'll receive prediction results along with key evaluation metrics.

Model Inputs - Propensity Score Matching

This model estimates the likelihood of algorithmic collusion in rent pricing using RealPage's pricing algorithm. It uses characteristics such as property size, year built, market concentration, and occupancy rates to generate a propensity score. It is also determining what rent (\$USD) a property using RealPage would charge if it did not use RealPage through controlled for characteristics.

You don't need exact values — feel free to try out different inputs to explore how the model responds. It's a tool for learning, not precision.

Note: The model is based on historical data and may not reflect current market conditions. The results should be interpreted with caution and in conjunction with other market analysis tools.

Disclaimer: The model is for educational purposes only and should not be used for investment decisions. The authors are not responsible for any financial losses incurred based on the model's predictions. Need help finding inputs? Visit the [interactive map](#) to explore market values by city or submarket.

Average Square Footage ⓘ

875

Need help? Use the [interactive map](#) to find common market values.

Age of the Building's passcode for upstares. ⓘ

2000

Unit Count ⓘ

100

Propensity Score: 0.3449

ATT (Effect of RealPage): \$0.26

RPSF (RealPage): \$2.27

RPSF (Non-RealPage): \$2.01

Propensity Score: 0.3449

This score represents the estimated probability that a property uses RealPage to determine pricing. Higher values indicate that a property with these characteristics is using the RealPage algorithm.

Average Treatment Effect on the Treated (ATT): \$0.26

This value estimates the average difference in rent per square foot attributable to using RealPage pricing tools versus not using them.

Predicted RPSF (RealPage Users): \$2.27

Predicted RPSF (Non-RealPage Users): \$2.01

These are the predicted rent per square foot (\$USD) values for properties using and not using RealPage, respectively.

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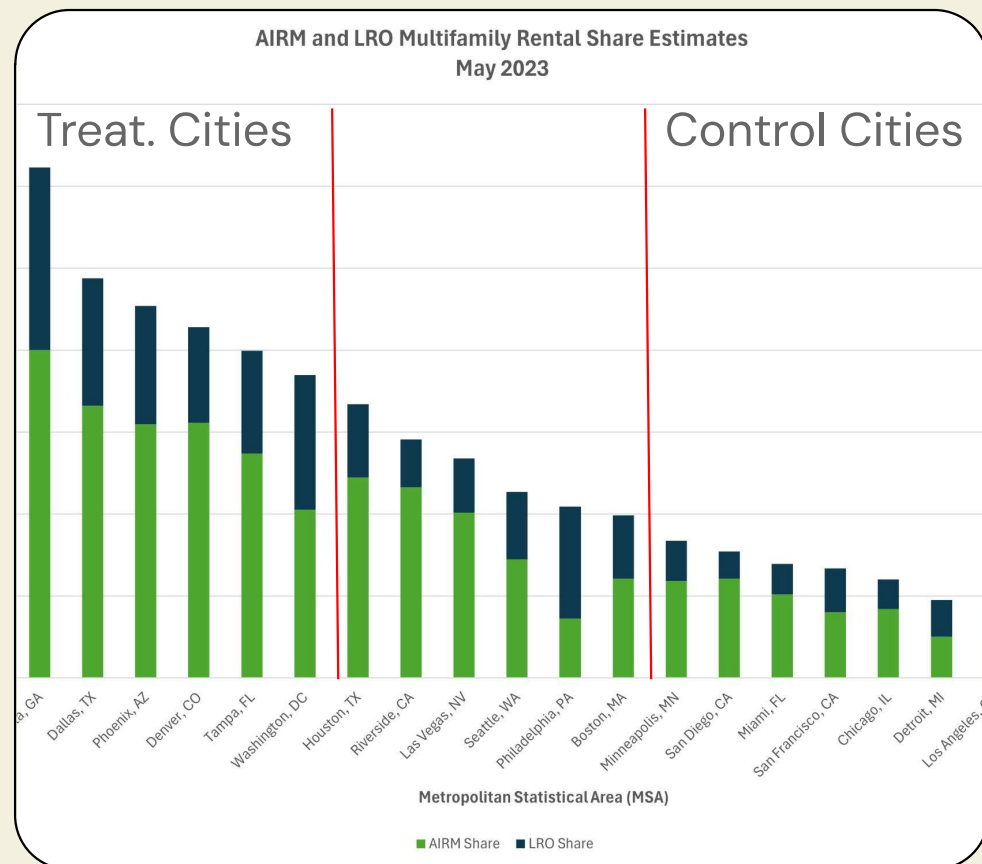
RealPage & Census Market Data

2017 RealPage-LRO Merger

RealPage acquired LRO, their largest competitor, in December 2017.

Did this impact rent? If so, that might
causal evidence of price coordination.

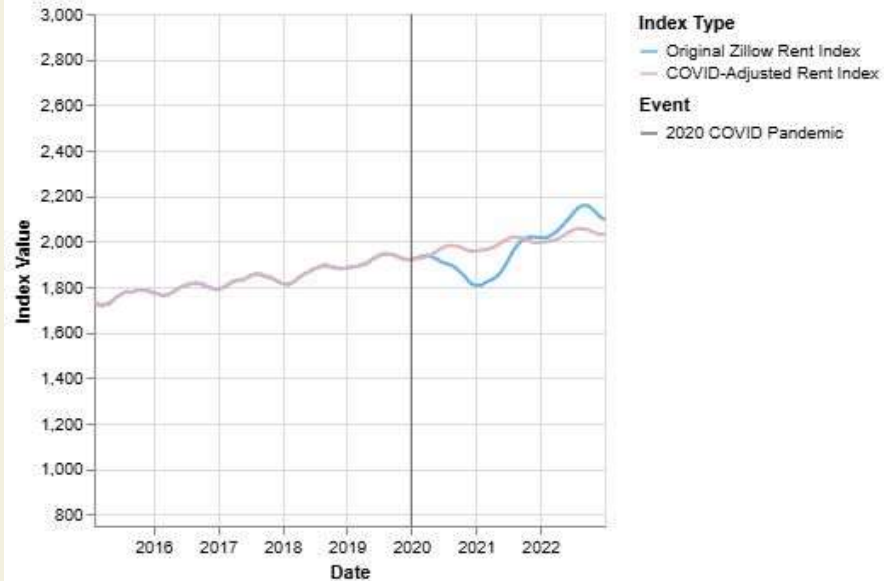
City	Total Share	Share Gain
Atlanta, GA	62.3%	22.3%
Dallas, TX	48.8%	15.6%
...
Los Angeles, CA	7.7%	2.9%
New York, NY	3.6%	2.2%



COVID Adjustment

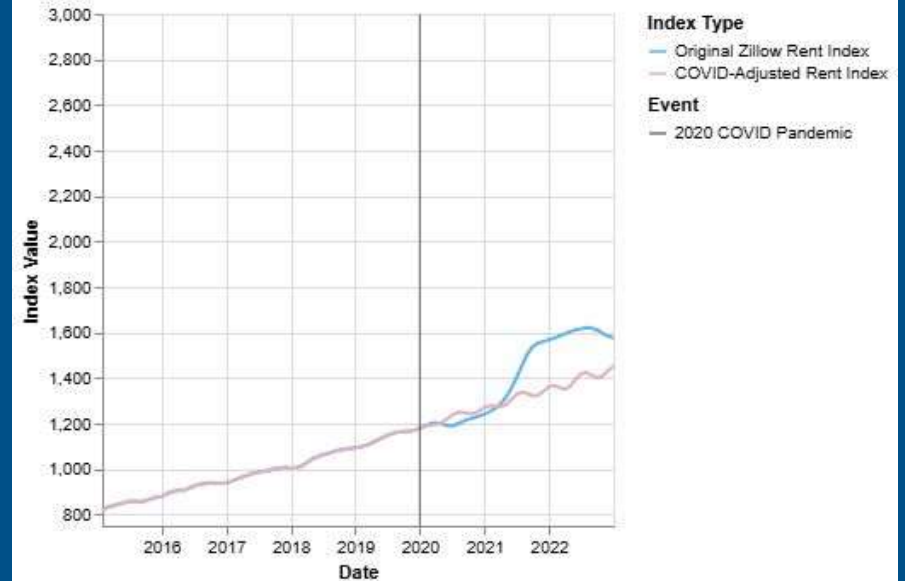
Washington, DC

Zillow Index and COVID Adjustment
2015 - 2022



Phoenix, AZ

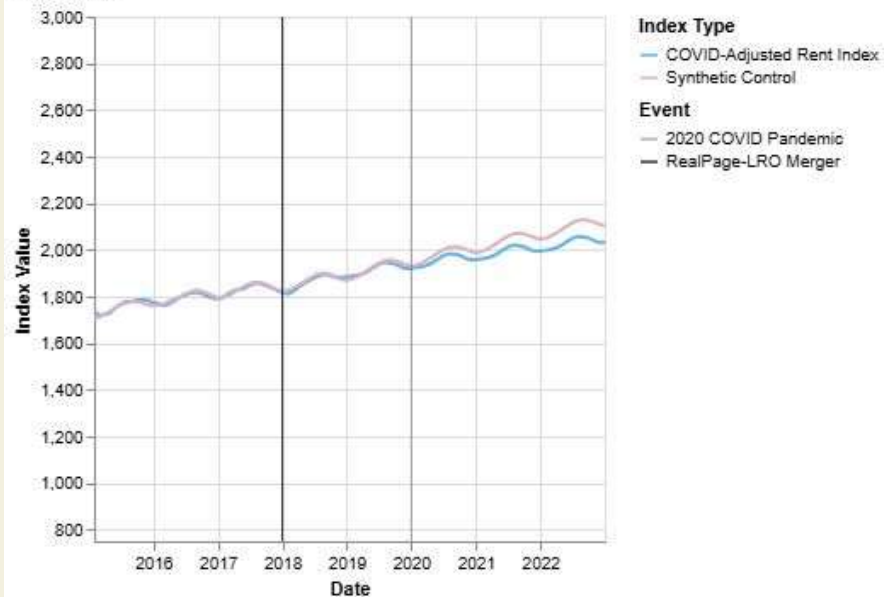
Zillow Index and COVID Adjustment
2015 - 2022



Synthetic Control

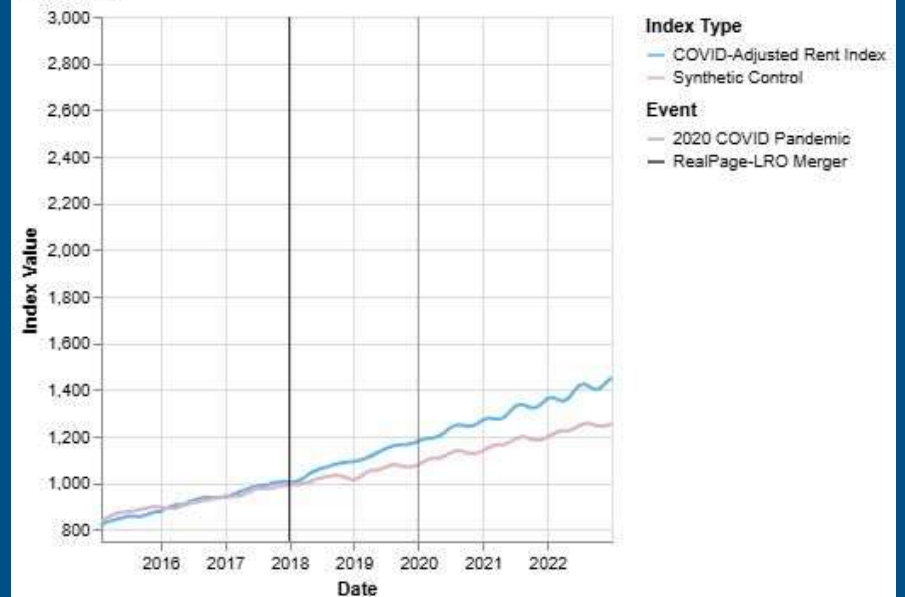
Washington, DC (Rent Decrease)

High-Share Cities and their Synthetic Controls
2015 - 2022



Phoenix, AZ (Rent Increase)

High-Share Cities and their Synthetic Controls
2015 - 2022



**Zillow Data
COVID-Adjusted**

Synthetic Control Results

Average Treatment Effect values for the 6 treatment cities are inconsistent.

- Rent Increases for Phoenix
- Rent Decreases for Washington
- Near zero for Tampa

Other cities are not statistically significant.

Robustness checks also lead to inconsistent results.

City	Average ATT	P-Value
Atlanta, GA	-28.40	0.567
Dallas, TX	-69.63	0.166
Denver, CO	-7.63	0.934
Phoenix, AZ	103.74	0.000***
Tampa, FL	-1.55	0.017***
Washington, DC	-30.46	0.000***

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Summary of Findings

Models Show a Rent Impact

Propensity Score model shows
+ \$0.23 increase in rent per
square foot

Controls for unit size, building
size, building age, occupancy
rate, and geography

Impact Varies Based on Model

Not all models statistically
significant. Simulation using
Feed-Forward Neural Network
has a p-value over 0.4.

Price Coordination Unclear

No consistent evidence that the
2017 merger raised rent across
multiple cities.

Price coordination might still
exist, but it would be unrelated
to the merger.

Our Website

<https://uc-berkeley-i-school.github.io/realpage-rent-impact/>



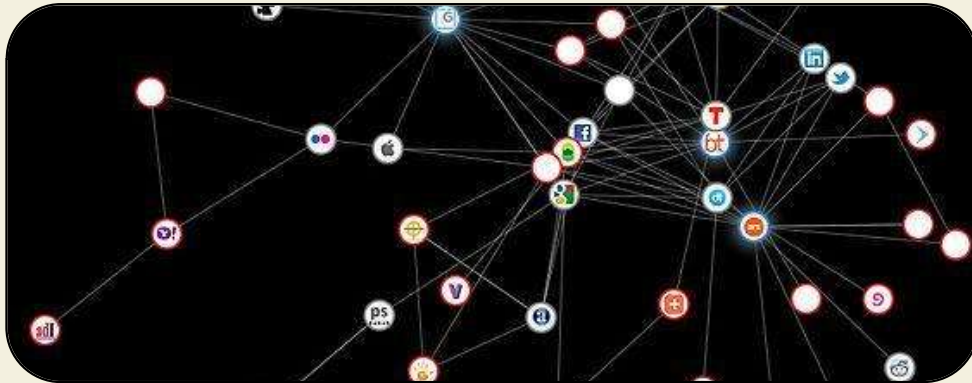
Our Paper

<https://uc-berkeley-i-school.github.io/realpage-rent-impact/research-paper.pdf>





THANK YOU



Tim Majidzadeh
Chelle Davies
Ahmad Allaou
Patrick Yim
Peter Benzoni

References

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