A STUDY OF THE DISTRICT OF COLUMBIA’S APARTMENT RENTAL MARKET 2000 TO 2015:

THE ROLE OF MILLENNIALS

A PRESENTATION TO THE FTA REVENUE ESTIMATION CONFERENCE
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Office of Revenue Analysis District of Columbia Government
INTRODUCTION

- DC has undergone remarkable commercial & residential development and demographic changes over the past 20 years
- Gentrification vs. youthification
- We test the hypothesis of youthification by looking at the profile of tenants of large apartment buildings built over the past 18 years
- Data used: CoStar data and DC individual income tax data
- Regression analysis with binary choice framework
- Findings:
  a) Evidence of continued gentrification
  b) Evidence of youthification: in the city’s newest and pricier apartment buildings are attracting new, single, younger residents with income below the city average
Population is growing at a faster rate than the city’s stock of housing.

**Causes:**
- Accelerating land & construction costs per sq. ft.
- Zoning
- Decreasing supply of land

**Consequence**
- Decreasing vacancy rate
DC’s home ownership rate of 39.8% was the lowest in the nation (as of 2017).

Cause: High cost of homes and homeownership

Median home price increased 8.3 percent per year

Inflation: Only 2.3%
# of Single-family home and condo sales averaged 4.9% annual rate between 2009-2017

Population growth averaged 2.5%

- One of the key explanatory factors in the city’s robust residential development
Renting has been the preferred housing option.

Between the years 2013 and 2017, the city added over 4,200 multifamily units per year on average.

- **Premium buildings (Class A and Class B)**

- CoStar Data
In 2017, one-bedroom rents at $2,184

Rental rates have generally grown over time in line with the area’s consumer price index

In comparison, median home price increased 8.3 percent per year
### Scenarios of Estimated Minimum Annual Household Incomes
For District of Columbia Rental Units in 2015

#### Rent as Share of Gross Monthly Income: 40%

<table>
<thead>
<tr>
<th></th>
<th>Studio</th>
<th>1 Bdrm</th>
<th>2 Bdrm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Household Gross Income</td>
<td>$56,280</td>
<td>$66,210</td>
<td>$94,380</td>
</tr>
<tr>
<td>Monthly Household Gross Income</td>
<td>$4,690</td>
<td>$5,518</td>
<td>$7,865</td>
</tr>
<tr>
<td>Estimated Monthly Rent</td>
<td>$1,876</td>
<td>$2,207</td>
<td>$3,146</td>
</tr>
</tbody>
</table>

#### Rent as Share of Gross Monthly Income: 50%

<table>
<thead>
<tr>
<th></th>
<th>Studio</th>
<th>1 Bdrm</th>
<th>2 Bdrm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Household Gross Income</td>
<td>$45,024</td>
<td>$52,968</td>
<td>$75,504</td>
</tr>
<tr>
<td>Monthly Household Gross Income</td>
<td>$3,752</td>
<td>$4,414</td>
<td>$6,292</td>
</tr>
<tr>
<td>Estimated Monthly Rent</td>
<td>$1,876</td>
<td>$2,207</td>
<td>$3,146</td>
</tr>
</tbody>
</table>

#### Affordability and Housing
- 30% income threshold: HUD definition of housing affordability
- 40% and 50%: moderately to severely housing cost burdened
- Cost-savings measures to reduce housing costs
- Should expect few renters with income below $45k or $56k
### Summary Statistics of 2015 Tax Filer Data

<table>
<thead>
<tr>
<th># of Tax Filers</th>
<th>10,814</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Income Statistics</strong></td>
<td>$ Amount</td>
</tr>
<tr>
<td>Mean Income</td>
<td>$75,945</td>
</tr>
<tr>
<td>Median Income</td>
<td>$57,428</td>
</tr>
<tr>
<td>Minimum Income</td>
<td>-$998,487</td>
</tr>
<tr>
<td>Maximum Income</td>
<td>$5,799,739</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>$117,874</td>
</tr>
<tr>
<td><strong>Income Tax Filer Type</strong></td>
<td>Share</td>
</tr>
<tr>
<td>Single Filers (Share)</td>
<td>83.0%</td>
</tr>
<tr>
<td>Married Filers (Share)</td>
<td>11.0%</td>
</tr>
<tr>
<td>Head of Household Filers (Share)</td>
<td>4.5%</td>
</tr>
<tr>
<td>Other Filers (Share)</td>
<td>1.5%</td>
</tr>
<tr>
<td><strong>Residents</strong></td>
<td>Age</td>
</tr>
<tr>
<td>Mean Age</td>
<td>34.2</td>
</tr>
<tr>
<td>Median Age</td>
<td>31.5</td>
</tr>
<tr>
<td><strong>City Tenure</strong></td>
<td>Share</td>
</tr>
<tr>
<td>Newest Residents</td>
<td>64%</td>
</tr>
<tr>
<td>Longer-term Residents</td>
<td>36%</td>
</tr>
</tbody>
</table>

### AFFORDABILITY AND HOUSING

- Half of the 10,814 residents had an annual income of less than $57,428.
- Median household incomes in DC was $70,848 in 2015 per Census.
- 1 bedrooms: 57%
  2 or more bedrooms: 26% and studios: 17%
- Room-mating is a predominant feature.
Data:

- CoStar: 88 Class A and Class B large and mid-sized apartment buildings built after 2000; containing 11,507 total residential units
  - Also contains information such as rents, vacancy, units number, types of units, and unit sizes.

- Individual income tax data for renters who lived in one of the 88 apartment buildings in 2015

To better evaluate the data, we bifurcate the building and tax filer data into two cohorts or groups

- The control group is comprised of residents in 48 multifamily buildings that delivered between January 2000 and December 2012 – older buildings
- The treatment group is comprised of residents in 40 multifamily buildings that delivered between January 2013 and December 2015

THE MODEL

- Binary choice model: \( y = 1 \) if an individual resides in a newer premium building or an older premium buildings \( y = 0 \) in 2015

- Regression: \( E(y_i | x) = F(x_i \beta) \)

- Marginal Effects:
  \[
  \frac{\partial F(x_i \beta)}{\partial x} = \beta * F'(x_i \beta) = \beta * f(x_i \beta)
  \]
## Results of T-Tests

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Average Square Feet per Unit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>748.6 (18.7379)</td>
<td>836.8 (21.3084)</td>
<td>-88.26*** (28.9452)</td>
</tr>
<tr>
<td><strong>Average Effective Rent per Sq. Foot</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$3.28 (0.1248)</td>
<td>$2.79 (0.0987)</td>
<td>$0.49*** (0.1871)</td>
</tr>
<tr>
<td><strong>Vacancy Rates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.00 (0.5325)</td>
<td>4.86 (0.4726)</td>
<td>1.1377 (0.7101)</td>
</tr>
<tr>
<td><strong>Mean Tenants Income</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$70,297.0 (1,193.8)</td>
<td>$80,181.2 (1,768.1)</td>
<td>-$9,884.1*** (2,288.7)</td>
</tr>
<tr>
<td><strong>Average Age of Tenants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>33.41 (0.1173)</td>
<td>34.76 (0.1341)</td>
<td>-1.3458*** (0.1882)</td>
</tr>
<tr>
<td><strong># of Apartment Buildings</strong></td>
<td>40</td>
<td>48</td>
<td></td>
</tr>
</tbody>
</table>

- Units in newer buildings are on average 88.3 square feet (10.5%) smaller
- They cost 17.5 percent more per square foot
- Tenants in newer buildings have $9,884 (12.3%) less income
- They are 1.3 years younger than renters in older buildings
Probit Regression Results on Apartment Choice: Average Partial Effects (APE) of Explanatory Variables on Probability of Choosing Newer Apartment Buildings

<table>
<thead>
<tr>
<th>Dep: Apartment Choice (1 if newer and 0 if older)</th>
<th>Model 1: Full Sample</th>
<th>Model 2: Income $20k-$250k</th>
<th>Model 3: Income $20k-$250k with Ward Dummies New Residents</th>
<th>Model 4: Income $20k-$250k with Ward Dummies Existing Residents</th>
<th>Model 5: Income $20k-$250k with Ward Dummies Existing Residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC AGI ($000’s)</td>
<td>-0.009%* (0.00006)</td>
<td>0.007% (0.0001)</td>
<td>0.046%*** (0.0001)</td>
<td>0.031%* (0.0002)</td>
<td>0.039%*** (0.0002)</td>
</tr>
<tr>
<td>Business Income Binary</td>
<td>6.028%*** (0.0141)</td>
<td>5.361%*** (0.0162)</td>
<td>4.395%*** (0.0159)</td>
<td>5.037%*** (0.0209)</td>
<td>3.120% (0.0244)</td>
</tr>
<tr>
<td>Capital Gains Binary</td>
<td>-3.767%*** (0.0118)</td>
<td>-4.523%*** (0.0129)</td>
<td>-2.331%* (0.0127)</td>
<td>-2.855%* (0.0161)</td>
<td>-1.545% (0.0206)</td>
</tr>
<tr>
<td>New Resident</td>
<td>1.529% (0.0103)</td>
<td>1.513% (0.0112)</td>
<td>2.747%*** (0.0111)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Age</td>
<td>-0.382%*** (0.0006)</td>
<td>-0.452%*** (0.0007)</td>
<td>-0.538%*** (0.0007)</td>
<td>-0.207%*** (0.0010)</td>
<td>-0.867%*** (0.0010)</td>
</tr>
<tr>
<td>FS HOH</td>
<td>12.721%*** (0.0234)</td>
<td>13.089%*** (0.0274)</td>
<td>7.873%*** (0.0283)</td>
<td>2.880% (0.0426)</td>
<td>12.166%*** (0.0384)</td>
</tr>
<tr>
<td>FS Married</td>
<td>-3.138%*** (0.0156)</td>
<td>-3.852% (0.0176)</td>
<td>-4.957%*** (0.0173)</td>
<td>-1.307% (0.0286)</td>
<td>-10.275%*** (0.0271)</td>
</tr>
<tr>
<td>Ward 1</td>
<td>--</td>
<td>--</td>
<td>-4.275%*** (0.0144)</td>
<td>-5.245%*** (0.0182)</td>
<td>-2.276% (0.0234)</td>
</tr>
<tr>
<td>Ward 2</td>
<td>--</td>
<td>--</td>
<td>-17.699%*** (0.0151)</td>
<td>-19.794%*** (0.0185)</td>
<td>-12.599%*** (0.0288)</td>
</tr>
<tr>
<td>Ward 3</td>
<td>--</td>
<td>--</td>
<td>-5.295%* (0.0278)</td>
<td>-8.474%** (0.0350)</td>
<td>-0.844% (0.0453)</td>
</tr>
<tr>
<td>Ward 4</td>
<td>--</td>
<td>--</td>
<td>12.751%*** (0.0230)</td>
<td>16.623%*** (0.0306)</td>
<td>7.678%*** (0.0384)</td>
</tr>
<tr>
<td>Ward 5</td>
<td>--</td>
<td>--</td>
<td>23.305%*** (0.0208)</td>
<td>21.590%*** (0.0263)</td>
<td>25.712%*** (0.0336)</td>
</tr>
<tr>
<td>Ward 7 &amp; 8</td>
<td>--</td>
<td>--</td>
<td>14.086%*** (0.0329)</td>
<td>21.756%*** (0.0512)</td>
<td>9.792%** (0.0445)</td>
</tr>
<tr>
<td># of observations</td>
<td>10,680</td>
<td>8,761</td>
<td>8,761</td>
<td>5,402</td>
<td>3,389</td>
</tr>
<tr>
<td>McFadden R-squared</td>
<td>0.0095</td>
<td>0.0083</td>
<td>0.0409</td>
<td>0.0431</td>
<td>0.0482</td>
</tr>
</tbody>
</table>

Regression Results

- Model 1 is for all data, as described in the summary statistics table.
- Model 2: To prevent the possibility of extreme income amounts distorting the model's results, we subset the data to residents with incomes between $20,000 and $250,000.
- Model 3 adds ward dummies.
- When we control for wards, the income variable becomes statistically significant and positive, as expected.
- Model 1 & 2 were confounding geographical differences of residents across wards – which is a model misspecification.
- Residents are more likely to reside in new buildings when they are in Wards 4, 5, 7 and 8, especially in Ward 5, where gentrification is happening at fast pace.
Model 4 analyzes building choices of only new residents. Model 5 analyzes such choices for only existing DC residents. Results are quite different for these two groups. Age and filing status have a much larger impact for existing residents in their building choice. For existing residents, a HOH is 12.2% more likely (compared to single status) to live in a new building, while this percentage is statistically insignificant for new residents. This may be reasonable given that the waitlist for ADUs is long and that some applicants wait for more than a year to attain a city-government facilitated ADU.

**Regression Results - Model 4 & 5**

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- Model 5 analyzes such choices for only existing DC residents.
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- For existing residents, a HOH is 12.2% more likely (compared to single status) to live in a new building, while this percentage is statistically insignificant for new residents.
- This may be reasonable given that the waitlist for ADUs is long and that some applicants wait for more than a year to attain a city-government facilitated ADU.
Large multi-family buildings (over 2,500 new ones between 2005-2015)

- Only responsible for 4.4% of all property taxes in 2015
- This equates to $96.2 million
As a comparison, the city's large office buildings (547 in 2005 and 614 in 2015) are responsible for much more property tax. They paid $1.032 billion of $2.194 in 2015, equating to 47%.
A sample of large apartment buildings that were built after 2000 in Wards 2 and 6 (i.e. the commercial core of the city), each of these relatively new apartment units, on average, contributed $2,542 in real property taxes and $3,334 in income taxes to the city's tax collections in 2015 (Figure 2).

With the exception of Ward 3, Wards 2 and 6 had the highest average incomes in the city.
Average District Taxes Per Square Foot
By Building Type & Tax Type in 2015
(Wards 2 and 6)

- We use a sample of buildings built after 2000 in Wards 2 and 6 (where 91% of city’s office buildings are by sq. ft)
- Offices pay almost 4x more in property tax by square foot
- When income taxes are included for apartment buildings, total tax paid is ~56% of what office buildings pay
- Multi-family buildings not expected to account for more than 10 percent of all city property taxes in foreseeable future
- In spite of population growth and residential property development, the role large office buildings play for the city’s property tax collections will remain prominent
1. The newest apartment units are getting more expensive likely because the rent per unit is remaining relatively constant while the average square footage is getting smaller.

2. Residents with incomes of $250,000 or more tend not to live in the newest apartments, likely because of their preference and ability to afford larger housing units.

3. For residents earning between $20k and $250k, there is a positive correlation between income levels and the probability to live in the newest apartments (0.05% for each additional $1000).

4. Residents in the city’s newer buildings were 1.3 years younger than renters in older buildings and had $9,900 (12.3 percent) less AGI.

5. Residents in newer units are more likely to have business income in their AGI.

6. 64% of the tenants in both the newest and older units are new residents and single.

7. Surprisingly, newer buildings have more head of household (HOH) filers, possibly due to the city’s affordable housing efforts.
CONCLUSIONS

- Recent surge of premium apartment buildings is likely evidence of continued gentrification.

- Contrary to conventional wisdom, residents in city’s newest and pricier apartment buildings tended to be new residents to the city, single, younger and had income below the city average (youthification)

- Residents in newest buildings are more likely to have business income: gig economy

- Newer buildings have more HOHs, likely due to city’s affordable housing efforts

- Continued youthification and gentrification of the city’s evolving housing market are likely to have considerable implications on the residential and economic patterns of the city in the years to come.