CVIOG Housing Burden Project

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Background

- **Context**

  - Housing Insecurity

  - High rental rate (35.5%)

  - Significant Portion Without Mortgages (22.8%)

- **Client: Carl Vinson Institute of Government**

  - Provides research, consulting, and training services to Georgia's state and local governments.

  - Data-driven insights

    - Supports policy development and decision-making

    - Improve public services & the well-being of Georgia residents.

Project Overview

- **Cost Burden**

  - Spending 30%+ of income on housing

- **Examine the relationship between cost-burdened & various factors**

  - Demographic, Economic, Geographic, etc.

- **Explore differences in owner- and renter-occupied housing**

Research Question

What is the relationship between demographic, geographic, and economic features collected by the Census Bureau's American Community Survey on the percentage of owner- and renter-occupied housing that is classified as cost-burdened (e.g., 30% of their income dedicated to housing costs)?

Data Source:
United States Census Bureau
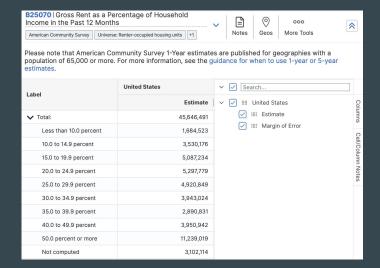
American Community Survey (ACS)

- **Conducted by the U.S. Census Bureau:** Provides detailed, annual data on U.S. communities.

- **Collects Detailed Demographic Data:** Income, housing, education, employment, etc.

- **Samples a Portion of the Population**

- **1-Year vs 5-Year Estimates**
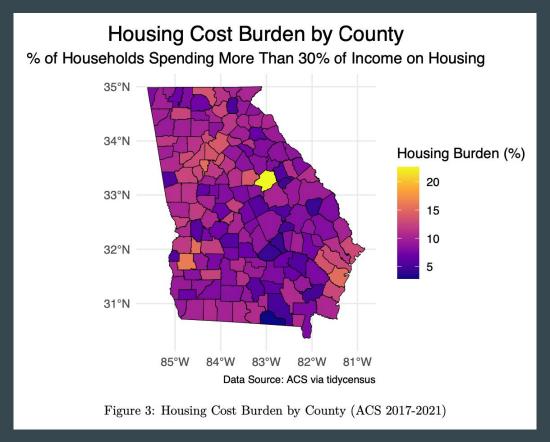
Dealing With the Data

- **Multiple Tables:**
  - Housing Cost Burden
  - Age, Income, Demographics

- **Aggregation:**
  - 159 rows, one for each GA county

- **tidycensus:**
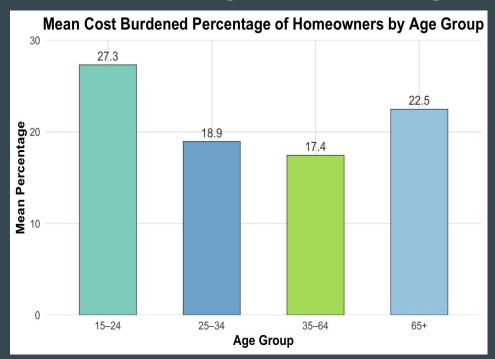 - Access census data

- **Missingness:**
  - Excluded small "not computed"

Exploratory Data Analysis

EDA - Housing Burden by County

Figure 3: Housing Cost Burden by County (ACS 2017-2021)

EDA - Housing Burden vs. Age and Race

Mean Cost Burdened Percentage of Homeowners by Age Group

- 15–24: 27.3
- 25–34: 18.9
- 35–64: 17.4
- 65+: 22.5

Mean Percentage vs. Age Group

Mean Cost Burdened Percentage of Owners by Race Group

- Black: 24.3
- Other: 21.3
- White: 16.2

Mean Percentage vs. Race Group

Methods

Methods

Welch's One-way ANOVA

- Checked assumptions: normality met (via Shapiro-Wilks), but Levene's test showed unequal variances
- Welch's ANOVA selected for robustness to unequal variances when comparing group means
- Four Welch's ANOVA models used to assess differences in cost-burden rates across various age and race groups for both renters and homeowners

Multiple Linear Regression

- MLR used for predicting cost-burden % for homeowners using predictors: urban status, % with bachelor's degree or higher, median household income, and unemployment rate
- Checked assumptions: normality (via Shapiro-Wilks), independence (via Durbin-Watson), and linearity met (via residual plots); homoscedasticity not met (via Breusch-Pagan)
- Fit a log transformation to the dependent variable, and ensured final model met all conditions

Methods (Cont.)

Weighted Least Squares Regression

- WLS regression used after MLR and log transformation failed to resolve heteroscedasticity
- Weighted by urban status to stabilize variance in residuals
- Checked assumptions and ensured final model met all conditions (independence, normality, etc.)

Results

Multiple Linear Regression

Log-transformed model

$$\log(\%OwnerCostBurden) = 3.167 - 0.00001 * MedHouseholdIncome$$
$$+ 0.01 * \%BachelorsOrHigher$$

Table 1: Coefficients for Final Log Model for Owner Occupied Cost Burden

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	3.167	0.063	50.427	0
MedHouseIncome	-0.00001	0.00000	-4.363	0.00002
percent_bachelors_higher	0.010	0.003	3.537	0.001

Table 2: Summary Statistics for Final Log Model for Owner Occupied Cost Burden

	Statistic	Value
1	R-squared	0.109
2	Adj. R-squared	0.097
3	F-statistic	9.517
4	p-value	0.0001

$$\%RenterCostBurden = 38.134 + 9.429 * isUrban$$
$$-0.00015 * MedHouseholdIncome$$
$$+0.351 * \%BachelorsOrHigher + \epsilon_i$$

Where:
$$Var(\epsilon_i) = \begin{cases} \sigma^2 & \text{if } isUrban_i = 0 \\ \theta^2\sigma^2 & \text{if } isUrban_i = 1 \end{cases}$$

Table 4: Breusch-Pagan Test Results

	Method	Statistic	df	p.value
BP	studentized Breusch-Pagan test	0.066	1	0.797

Weighted Least Squares Regression

Weighted Least Squares Regression (Cont.)

Table 5: Weighted Least Squares Model for Rent Burden

	Dependent variable:
	percent_renter_occupied_cost_burdened
Urban (isUrban = 1)	9.429
	(1.479)
	t = 6.377
	p = <0.001
Median Household Income	−0.0002
	(0.0001)
	t = −2.971
	p = <0.001
Percent with Bachelor's or Higher	0.351
	(0.094)
	t = 3.741
	p = <0.001
(Intercept)	38.134
	(2.235)
	t = 17.066
	p = <0.001
Observations	159
Log Likelihood	−559.308
Akaike Inf. Crit.	1,130.616
Bayesian Inf. Crit.	1,148.877

Note: GLS model weighted by varIdent(form = 1 | isUrban)

Welch's One-Way ANOVA

Owner-occupied households by age

Table 6: Welch's ANOVA Results for Cost Burden by Age Group (Owners)

	Source	DF	F_value	p_value
1	Between Groups	3	23.429	<0.001
2	Residuals	330.1600		

Table 7: Games Howell Test Results for Age Groups (Owners)

Comparison	P_Value
15-24 vs 25-34	0.005
15-24 vs 35-64	< 0.001
15-24 vs 65+	0.175
25-34 vs 35-64	0.439
25-34 vs 65+	0.004
35-64 vs 65+	< 0.001

Welch's One-Way ANOVA

Renter-occupied households by age

Table 8: Welch's ANOVA Results for Cost Burden by Age Group (Renters)

	Source	DF	F_value	p_value
1	Between Groups	3	7.5073	<.001
2	Residuals	340.1400		

Table 9: Games Howell Test Results for Age Groups (Renters)

Comparison	P_Value
15-24 vs 25-34	0.999
15-24 vs 35-64	0.974
15-24 vs 65+	0.043
25-34 vs 35-64	0.979
25-34 vs 65+	0.002
35-64 vs 65+	0.00004

Welch's One-Way ANOVA

Owner-occupied households by race

Table 10: Welch's ANOVA Results for Cost Burden by Race Group (Owners)

	Source	DF	F_value	p_value
1	Between Groups	2	31.201	<0.001
2	Residuals	235.1700		

Table 11: Games Howell Test Results for Race Groups (Owners)

Comparison	P_Value
White vs Black	<.001
White vs Other	0.031
Black vs Other	0.365

Welch's One-Way ANOVA

Renter-occupied households by race

Table 12: Welch's ANOVA Results for Cost Burden by Race Group (Renters)

	Source	DF	F_value	p_value
1	Between Groups	2	18.078	<.001
2	Residuals	267.9100		

Table 13: Games Howell Test Results for Race Groups (Renters)

Comparison	P_Value
White vs Black	<.001
White vs Other	0.9832
Black vs Other	0.0011

Conclusion

Geographical/Economical Takeaways

- Urban counties significantly increases cost-burden for renters vs. rural counties

- Higher income slightly reduces cost-burden for both owners and renters

- Higher education unexpectedly increases cost-burden for both owners and renters

Demographic Disparities

- **Owner-occupied households**
  - Young (15–24) & older adults (65+) face higher burdens vs. middle-aged groups
  - White homeowners face lower housing burdens than non-white homeowners
- **Renter-occupied households**
  - Adults 65+ have the highest burden among renters
  - Black renters face the highest housing burdens among racial groups

Further Exploration

Explore Other Indices
- HUD – Comprehensive Housing Affordability Strategy
- BLS – Consumer Expenditure Survey

Explore Other Models
- Spatial Autoregressive Model (SAR)
- Logistic Regression Model

Explore Other Variables
- Household Size, Vacancy Rate, Property Tax Rate
- Single vs. Multi Family Homes, Commute Times

Questions?