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ANALYZING THE INTERPLAY OF HOUSING RELATED FACTORS ACROSS VARIED STRUCTURE TYPES

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BIG DATA ANALYTICS

OVERALL SUMMARY

The project aimed to unravel complex relationships in the housing landscape, revealing a notable preference for "Single Family" (1 Unit) housing structures. Affordability dynamics varied, correlating single-family homes with higher incomes and multi-unit structures/mobile homes with more affordable options. Geographic analysis played a role to show distinct patterns in suburbs, central cities, and surprisingly spacious mobile homes.

Financial strain and assistance patterns showed variations, with single-family homes experiencing lower strain and mobile homes exhibiting self-sufficiency. Income disparities were evident across structure types, emphasizing dynamic interactions between income levels and housing choices. Temporal trends in construction reflected changing housing preferences over the years, with structure type 1 consistently lagging and fluctuations indicating dynamic influences on housing demand. Overall, the findings provide nuanced insights for policymakers, urban planners, and researchers in responding to evolving housing preferences and economic conditions.



BACKGROUND

The project aims to conduct a comprehensive analysis of diverse housing-related factors and their interconnections across different structure types. By delving into an extensive dataset, this analysis seeks to unravel the complex relationships between housing structure types, affordability, homeownership patterns, and assistance programs.

The dataset under scrutiny is a comprehensive repository of information capturing various dimensions of the housing landscape. It spans different geographic regions within America using The Housing Affordability Data System (HADS), providing a multifaceted perspective on the intricate interplay of factors influencing residential dynamics.

The project aims to yield a nuanced understanding of the intricate relationships between housing-related variables. The outcomes will provide valuable insights for stakeholders, policymakers, and researchers, guiding informed decision-making in urban planning, affordable housing initiatives, and economic policies.



DATA SCIENCE QUESTIONS

1. What is the distribution of housing structure types across the FMTMETRO3 areas?
2. How is the mix of homeowners and renters distributed among different types of housing structures?
3. What is the average housing cost for different structure types, and is there a correlation with the corresponding total average wage income?
4. What are the average room counts for various types of housing structures, and is there a connection between the average fair market rent (FMR) and the number of rooms?
5. What's the cost burden for different types of housing structures? Do certain types of structures tend to have higher cost burdens, and are they more likely to be under financial strain?
6. How do average household & additional costs vary for different housing structure types?
7. How does the distribution of assisted housing compare between different structure types? Are specific structure types more likely to receive assistance?
8. How does the difference in Cost relative to Median Income vary among the different housing structure types?
9. How is the distribution of structure types changing over the years in terms of construction?



OBJECTIVES

1. Regional Housing Diversity:

- Investigate and document the distribution of housing structure types across various metropolitan areas (FMTMETRO3).

2. Ownership Patterns and Affordability:

- Explore the mix of homeowners and renters within different housing structures.
- Determine the average housing costs for distinct structure types.

3. Spatial Dynamics:

- Examine the average room counts in various housing structures.
- Establish connections with the fair market rent (FMR) to understand spatial considerations.

4. Financial Dynamics:

- Investigate the cost burden for different housing structures.
- Explore variations in average household costs and additional expenses.

5. Assistance Programs and Economic Disparities:

- Compare the distribution of assisted housing across different structure types.
- Investigate how the difference in housing costs relative to median income varies among different structure types.

6. Temporal Evolution:

- Study the changing distribution of housing structure types over the years, focusing on construction trends.



METHODOLOGY

DATA COLLECTION & PREPROCESSING



Data Extraction: Gathering and loading housing related data, focusing on structure types.

Data Preprocessing: Handle missing values & duplicates, standardize formats, and merge datasets for compatibility.

EXPLORATORY DATA ANALYSIS

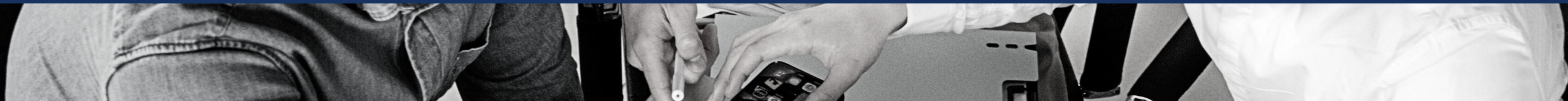


Examining & Exploring: Most common housing structure types & Distribution of the housing structure types across the four different regions.

RESULTS & VISUALIZATION



- Utilize statistical analysis techniques for pattern identification.
- Employ data visualization tools to communicate insights effectively.
- Apply descriptive statistics, correlation analysis, and time series analysis.
- Generate charts, graphs, and maps for enhanced interpretability.
- Gain comprehensive insights into housing dynamics across structure types.





Data Collection & Preprocessing

Data Extraction: Gathering and loading housing related data from Housing Affordability Data System.

Features Extracted:

"CONTROL", "FMTSTRUCTURETYPE", "REGION", "FMTMETRO3", "FMTTOWNRENT", "COSTMED", "TOTSLA", "ROOMS",
"FMR", "FMTBURDEN", "FMTASSISTED", "BUILT", "ZSMHC", "OTHERCOST", "FMTCOSTMEDRELAMICAT"

CONTROL	FMTSTRUCTURETYPE	REGION	FMTMETRO3	FMTTOWNRENT	COSTMED	TOTSLA	ROOMS	FMR	FMTBURDEN	FMTASSISTED	BUILT	ZSMHC	OTHERCOST	FMTCOSTMEDRELAMICAT
00003130103	'1 Single Family'	'1'	'-5'	'1 Owner'	867.8586601	0	6	1095	'1 Less than 30%'	'.'	2006	594	310.0	'2 30 - 50% AMI'
00003130203	'1 Single Family'	'1'	'-5'	'1 Owner'	2142.740555	0	5	1095	'1 Less than 30%'	'.'	2006	684	222.75	'6 100 - 120% AMI'
00006370140	'1 Single Family'	'3'	'-5'	'1 Owner'	1592.93464	58932	6	965	'1 Less than 30%'	'.'	1985	1549	79.16666667	'6 100 - 120% AMI'
00006520140	'1 Single Family'	'3'	'-5'	'1 Owner'	1323.421977	0	6	861	'2 30% to 50%'	'.'	1985	817	0.0	'5 80 - 100% AMI'
00007130148	'3 5-19 units'	'3'	'Central City'	'2 Renter'	701.0	15600	5	685	'3 50% or More'	'0 Not Assisted'	1980	701	9.0	'3 50 - 60% AMI'
00007390148	'4 20-49 units'	'3'	'-5'	'2 Renter'	382.0	27000	3	670	'1 Less than 30%'	'0 Not Assisted'	1985	382	0.0	'2 30 - 50% AMI'

Data Preprocessing:

- Checking for missing values
- Checking for duplicates
- Removing incomprehensible values



EDA (Exploratory Data Analysis)

Dominance of Single-Family (1 Unit) Structures:

- The prevalence of "Single Family" structures suggests a dominant housing preference, possibly indicating a cultural or demographic inclination towards detached residences.

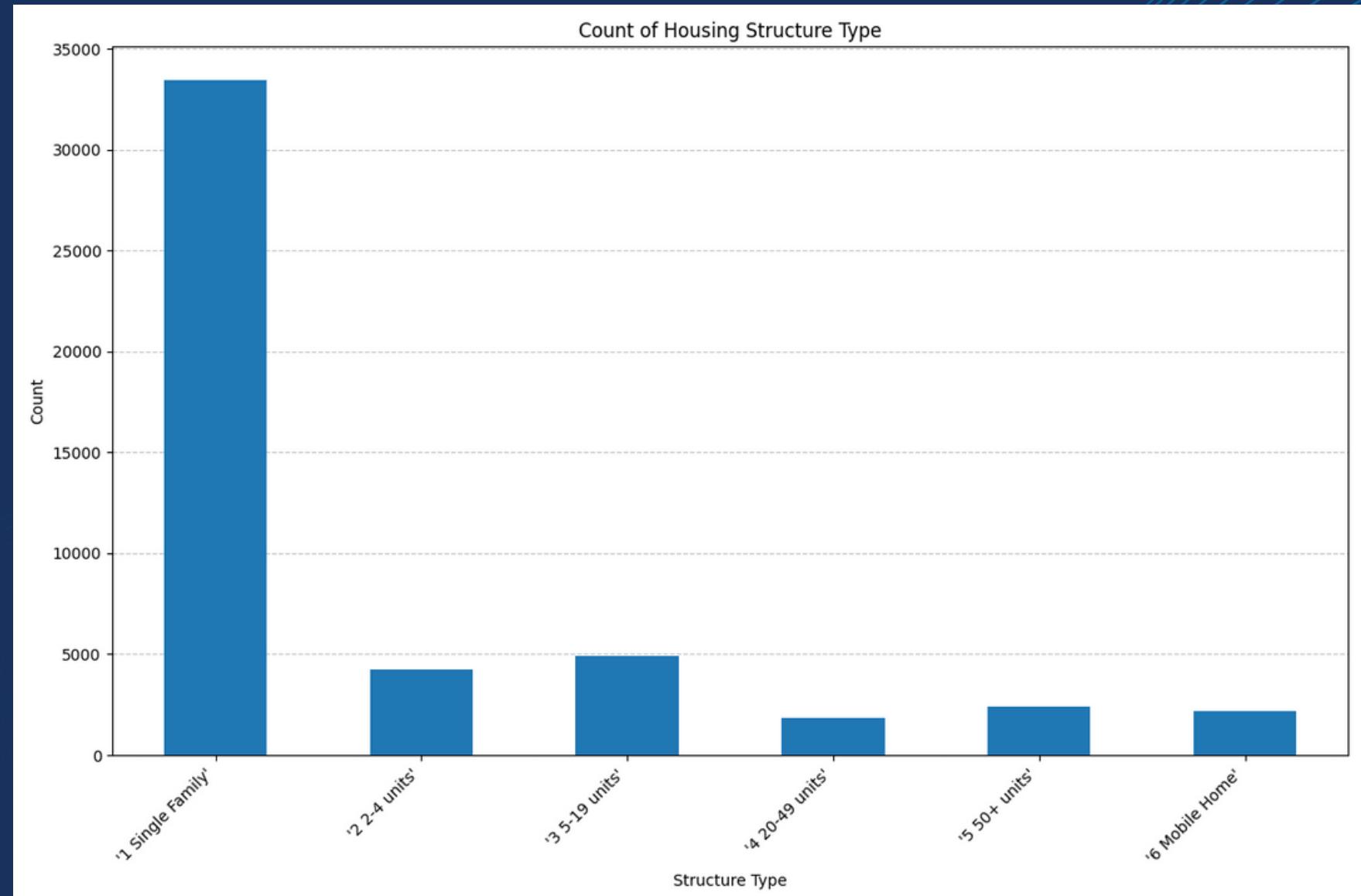
Potential Socioeconomic Insights:

- The dominance of single-family homes might indicate a preference for suburban or detached living, potentially linked to certain socioeconomic factors or lifestyle choices.

Potential Impacts on Affordability:

- The dominance of specific structure types may influence affordability dynamics. Understanding the correlation between the most common structures and housing costs can inform initiatives to address affordability challenges in specific housing categories.

Most common Housing Structure Types





EDA (Exploratory Data Analysis)

Regional Disparities in Housing Structures:

- Region 3 stands out with the highest distribution of housing structure types, indicating potential regional preferences, economic factors, or urban planning variations that contribute to this disparity.

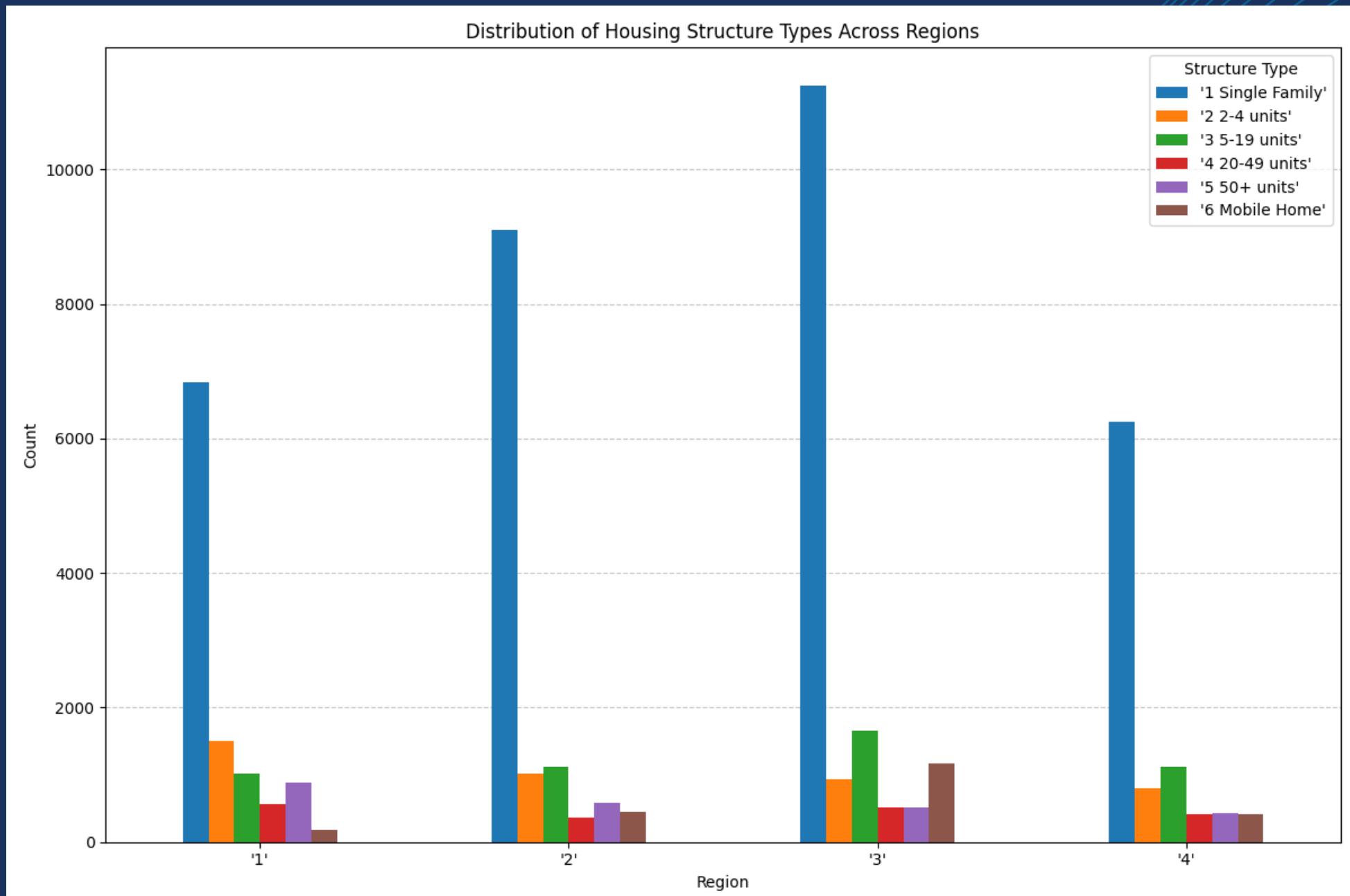
Consistent Patterns in Regions 1 and 2:

- Regions 1 and 2 exhibiting similar patterns in housing structure distribution suggest some degree of homogeneity or shared housing preferences between these adjacent regions. This could be influenced by common demographic or economic factors.

Policy Considerations for Mobile Homes:

- The outlier in Region 3 regarding mobile homes prompts consideration for region-specific housing policies.

Distribution of the housing structure types across the four regions





RESULTS & VISUALIZATIONS



1. WHAT IS THE DISTRIBUTION OF HOUSING STRUCTURE TYPES ACROSS THE FMTMETRO3 AREAS?

Single-Family Dominance in Suburbs:

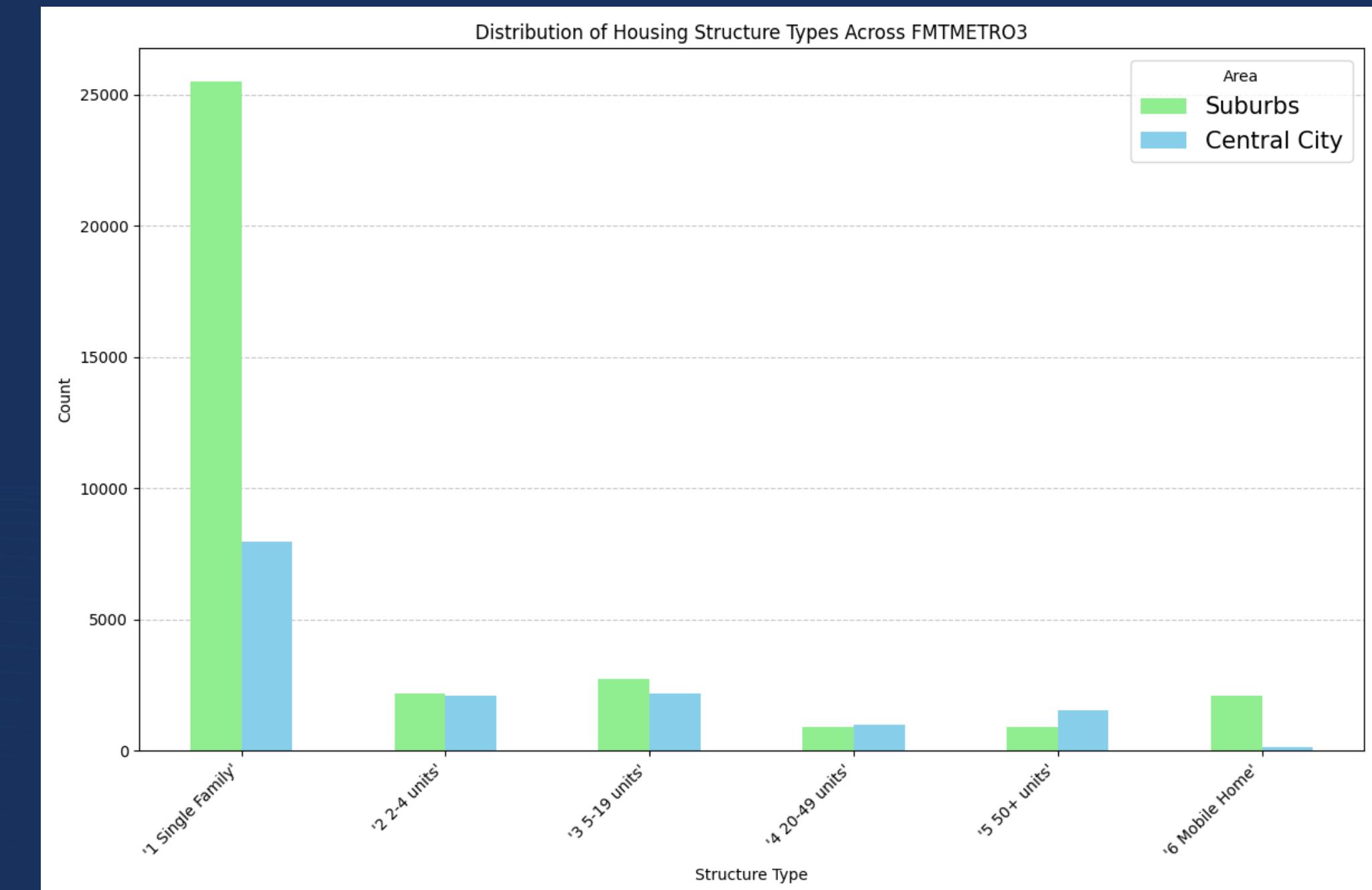
- The higher distribution of "Single Family" structures in the suburbs suggests a strong suburban preference for detached housing. This aligns with common perceptions of suburban living often associated with more spacious residences.

Central City Attraction for Large Structures (5 - 50+ Units):

- The fairly higher distribution of Structure 5 (50+ Units) in the central city implies an attraction towards larger multifamily structures in urban areas.

Suburban Exclusivity for Mobile Homes:

- The almost exclusive presence of Structure 6 (Mobile Home) in the suburbs (90%) suggests a specific suburban housing trend. This could be influenced by factors such as space availability, zoning regulations, or cultural preferences favoring mobile homes in suburban settings.



2. HOW IS THE MIX OF HOMEOWNERS AND RENTERS DISTRIBUTED AMONG DIFFERENT TYPES OF HOUSING STRUCTURES?

Single-Family Dominance for Homeowners:

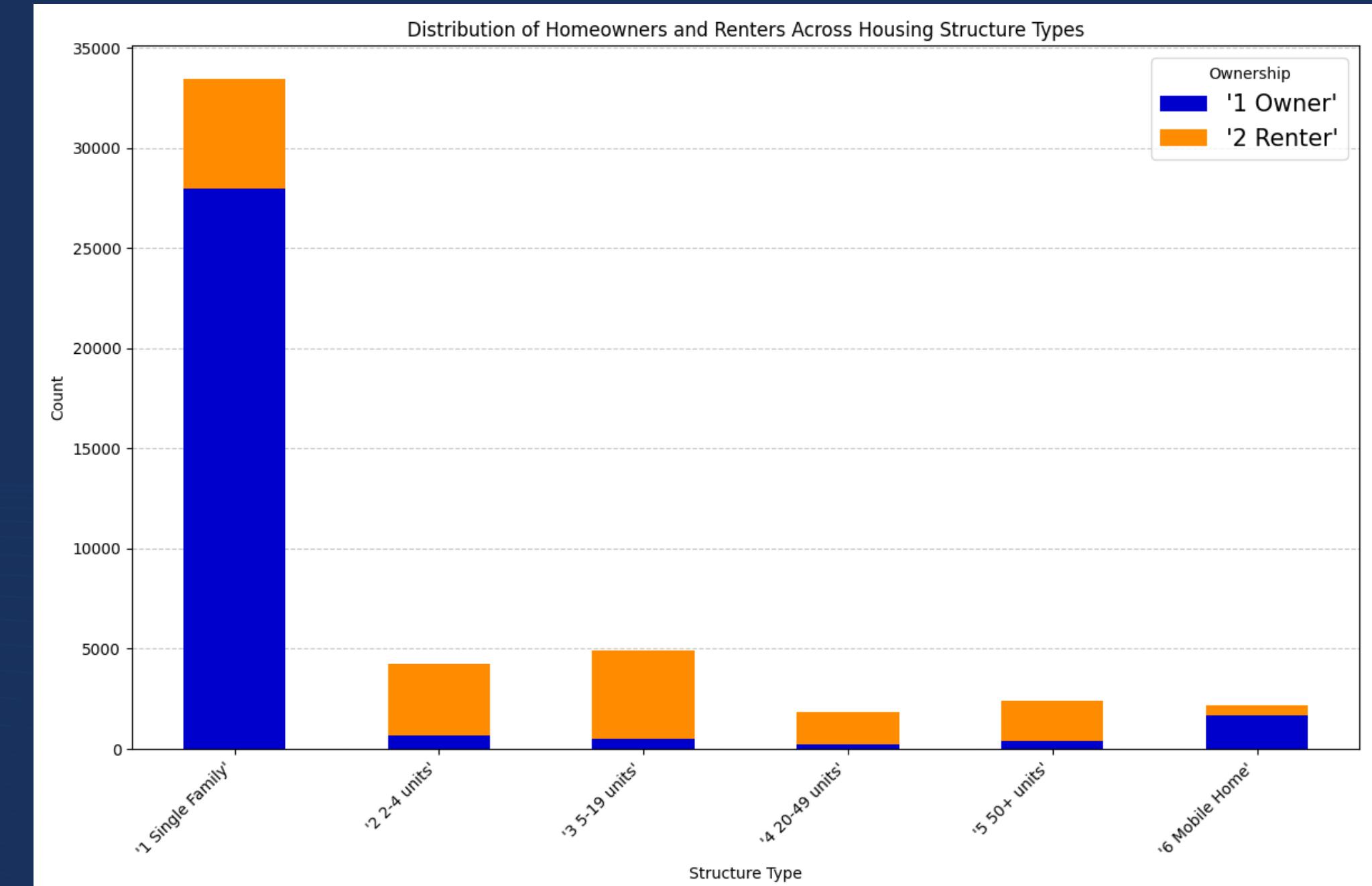
- The dominance of homeownership in Structure 1 (Single Family), with about 85%, suggests a strong preference for ownership in detached housing. This aligns with the traditional perception of single-family homes as owner-occupied residences.

Multifamily Structures Favor Renters:

- Structures 2, 3, 4, and 5, with more than 85% renters, indicate a prevalent trend of renting in multi unit settings. This could be influenced by factors such as urban living preferences, mobility, and the appeal of shared amenities in larger structures.

Mobile Homes: Homeownership Preference:

- Similar to single-family homes, Structure 6 (Mobile Home) exhibits a preference for homeownership. This suggests that despite being categorized differently, mobile homes share some homeownership characteristics with traditional single-family residences.



3. WHAT IS THE AVERAGE HOUSING COST FOR DIFFERENT STRUCTURE TYPES, AND IS THERE A CORRELATION WITH THE CORRESPONDING TOTAL AVERAGE WAGE INCOME?

Single-Family Homes and Higher Income:

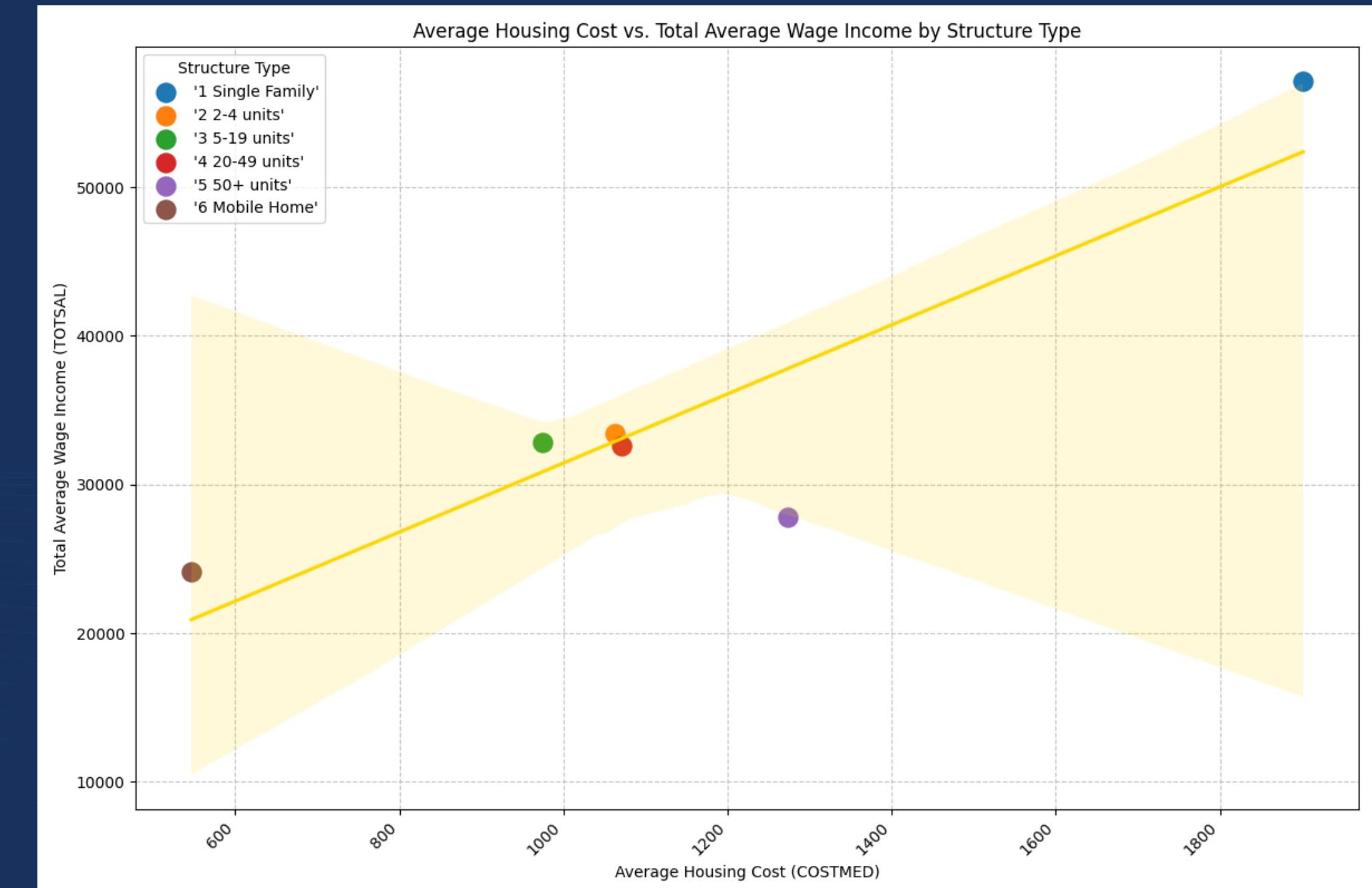
- Structure type 1, "Single Family," stands out with both the highest total average wage income (about 60k) and the highest average housing cost (about 2k). This suggests a correlation between higher income levels and the preference for detached single-family homes.

Moderate Income and Housing Costs for Structures 2-5:

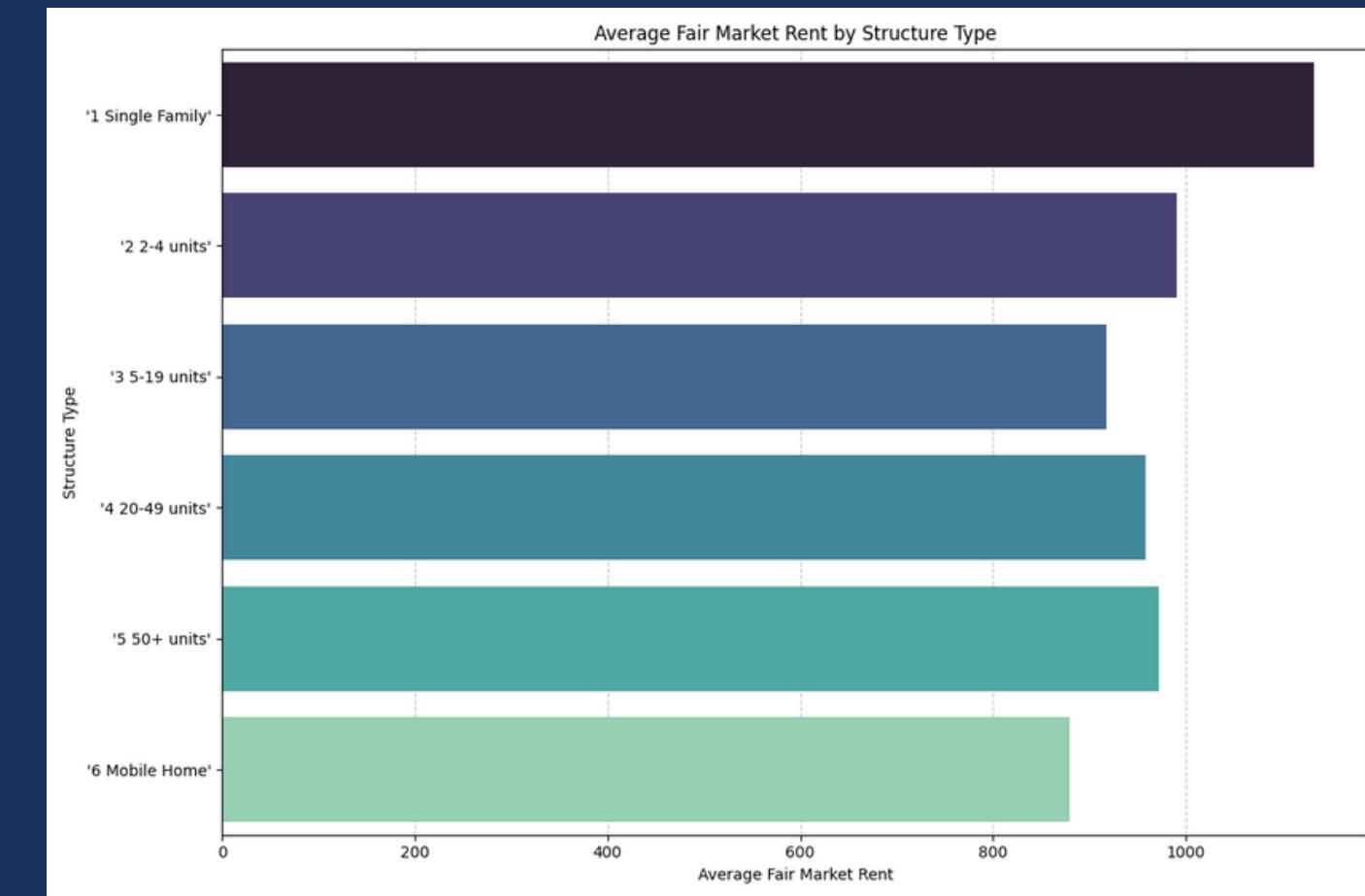
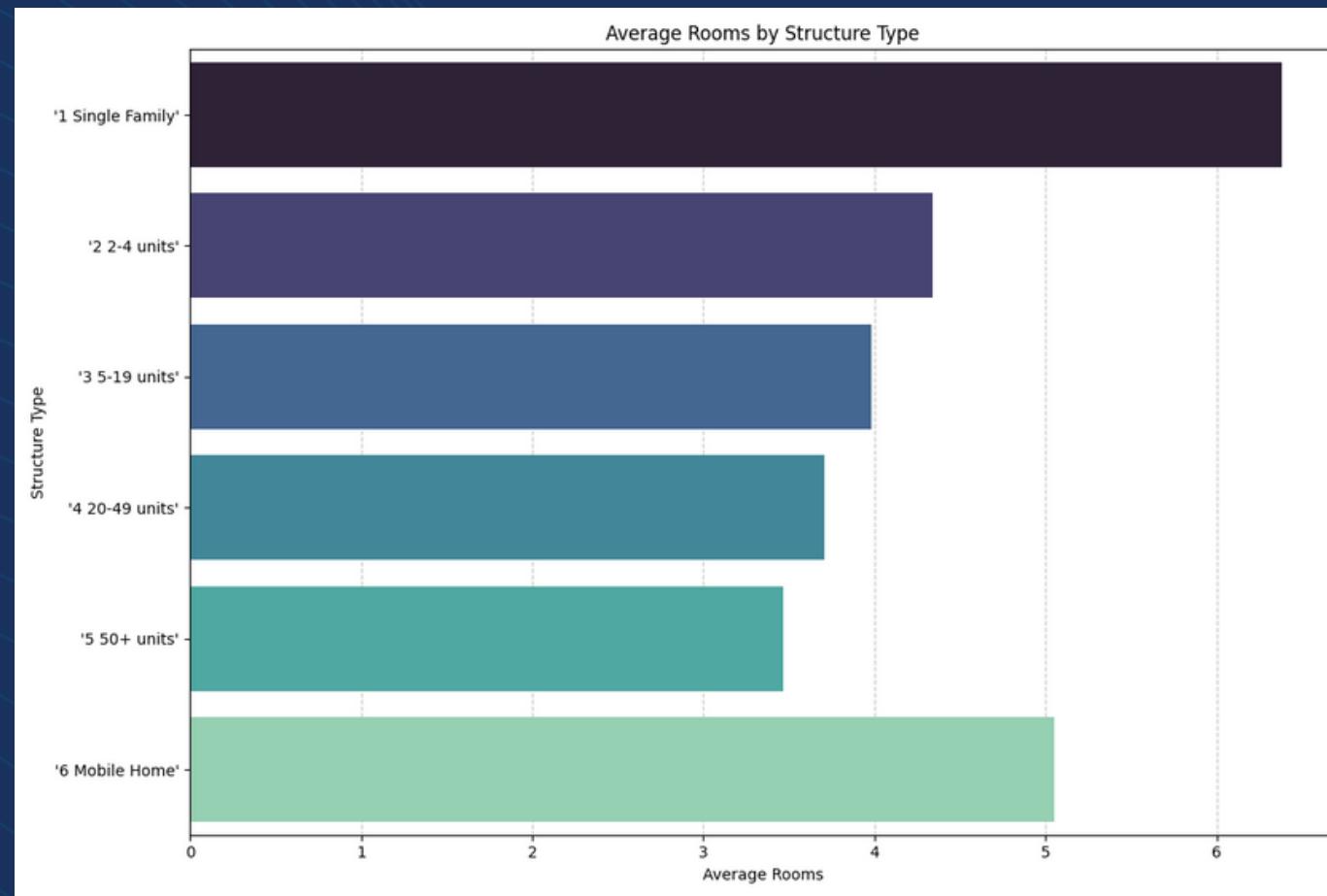
- Structures 2, 3, 4, and 5 exhibit a fairly consistent range of total average wage income (around 28k - 33k) and average housing costs (800 - 1250). This suggests that residents in these multi unit structures typically have moderate income levels and corresponding housing costs.

Mobile Homes and Affordability:

- Structure type 6, "Mobile Home," stands out with the lowest total average wage income (around 24k) and a relatively low average housing cost (about 550). This points to mobile homes being a more affordable housing option, attracting residents with lower income levels.



4. WHAT ARE THE AVERAGE ROOM COUNTS FOR VARIOUS TYPES OF HOUSING STRUCTURES, AND IS THERE A CONNECTION BETWEEN THE AVERAGE FAIR MARKET RENT (FMR) AND THE NUMBER OF ROOMS?



Single-Family Homes and Spacious Living:

- Structure type 1, "Single Family," stands out with the highest average room count of 6, indicating spacious living arrangements. However, the higher FMR (almost 1200) reflects the cost associated with the larger space, emphasizing the trade-off between space and rent.

Consistent Room Counts for Structures 2–5:

- Structures 2, 3, 4, and 5 exhibit fairly similar average room counts, ranging from 3.5 to 4.5. This suggests a commonality in the size and layout of living spaces for residents in these multifamily structures. The corresponding FMR (around 900 – 1000) aligns with the moderate room counts.

Mobile Homes and Surprising Spaciousness:

- Structure type 6, "Mobile Home," surprisingly has the second-highest average room count of 5. This suggests that mobile homes offer relatively spacious living despite being a more affordable housing option.

5. WHAT'S THE COST BURDEN FOR DIFFERENT TYPES OF HOUSING STRUCTURES? DO CERTAIN TYPES OF STRUCTURES TEND TO HAVE HIGHER COST BURDENS, AND ARE THEY MORE LIKELY TO BE UNDER FINANCIAL STRAIN?

Single-Family Homes and Low Cost Burden:

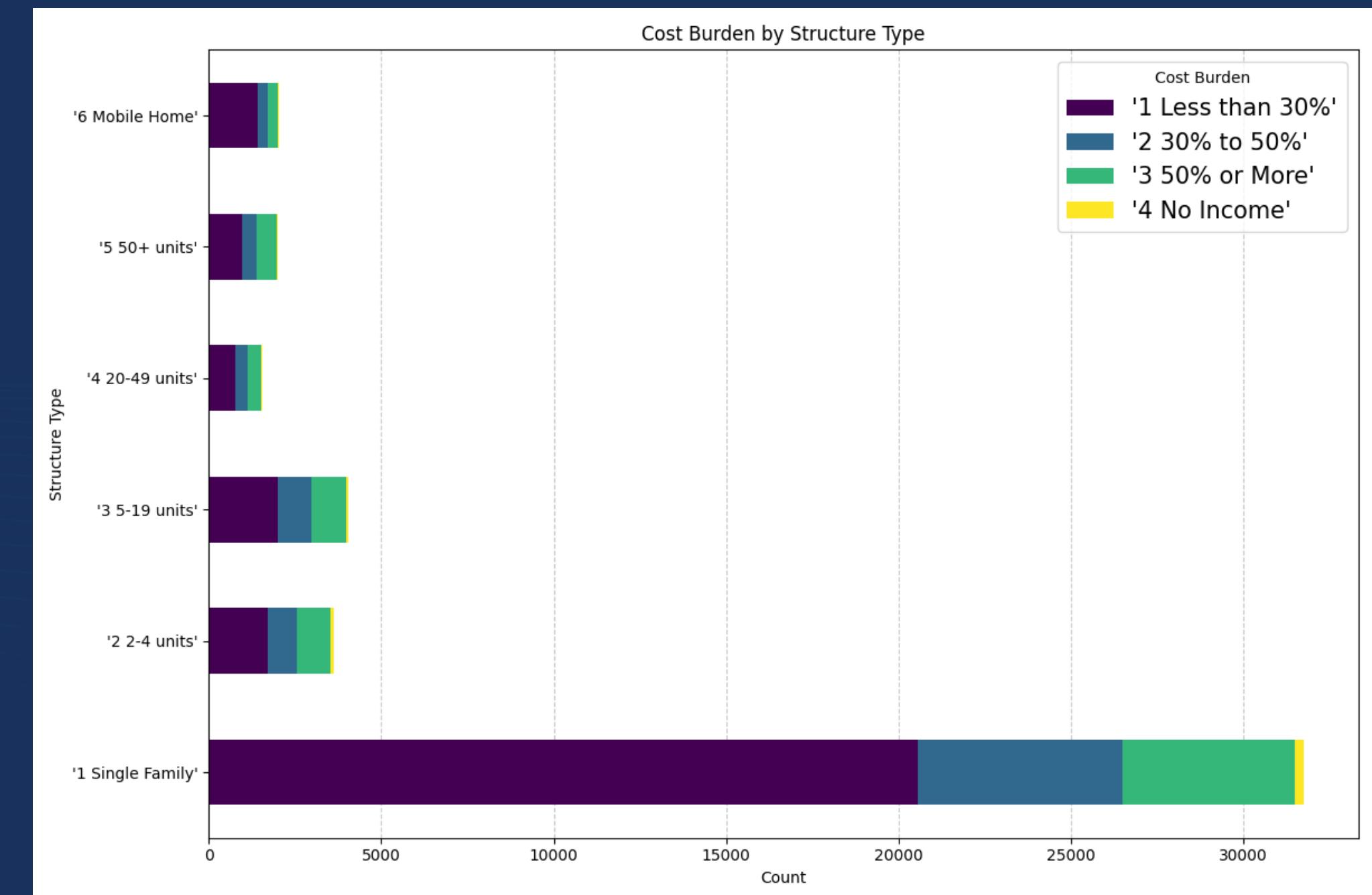
- Structure type 1, "Single Family," exhibits a notable majority (about 70%) reporting a cost burden of 30% or less. This suggests that a significant portion of residents in single-family homes experience a relatively low financial strain, aligning with the notion that these homes are often associated with higher income levels.

Consistent Cost Burden Distribution for Structures 2-5:

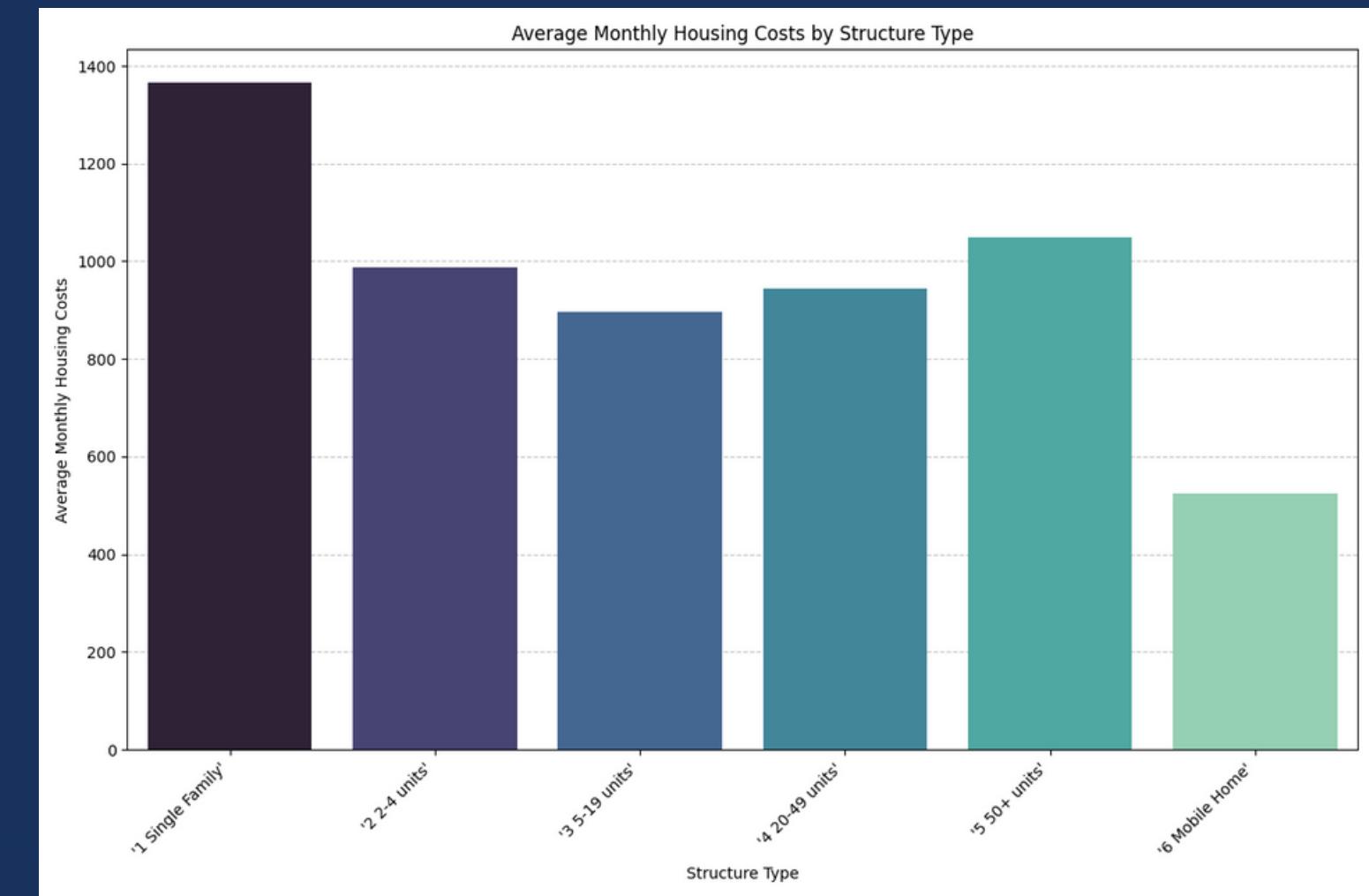
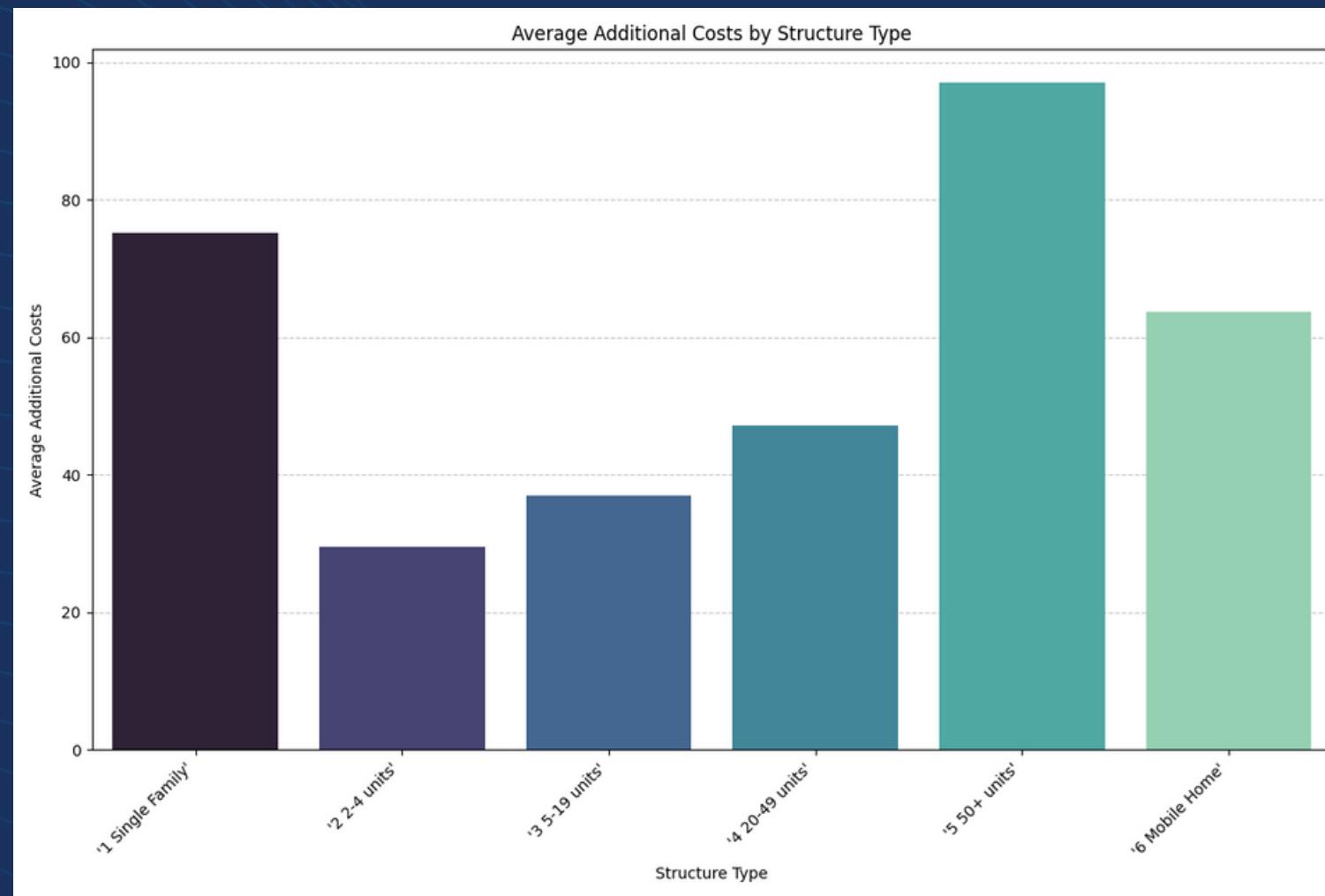
- Structures 2, 3, 4, and 5 display a fairly similar cost burden distribution, with approximately 50% reporting a cost burden of 30% or less. This consistency suggests that residents in these multifamily structures share a comparable level of financial strain, with the majority managing housing costs within a moderate range.

Mobile Homes and Low Financial Strain:

- Structure type 6, "Mobile Home," stands out with a high majority reporting a cost burden of 30% or less. This indicates that residents in mobile homes are less likely to experience financial strain related to housing costs. The affordability of mobile homes may contribute to this lower burden.



6. HOW DO AVERAGE HOUSEHOLD & ADDITIONAL COSTS VARY FOR DIFFERENT HOUSING STRUCTURE TYPES?



Monthly Housing Costs:

- Structure type 1, "Single Family," stands out with the highest average monthly housing cost, suggesting that residents in single-family homes allocate a significant portion of their budget to housing. This aligns with the perception of single-family homes as larger and potentially more expensive residences. Structures 2, 3, 4, and 5 exhibit fairly similar housing costs. Structure type 6, "Mobile Home," has the lowest average monthly housing cost, emphasizing the affordability of mobile homes. This aligns with the previous insights indicating mobile homes as a more budget-friendly housing option.

Additional Housing Costs:

- Structure type 5 (50+ units) has the highest average additional housing cost. This could be attributed to the scale of larger multifamily structures, which may entail additional expenses related to communal amenities, maintenance, or management. Single-family homes (Structure type 1) follow with the second-highest additional housing cost. This could be associated with the maintenance and upkeep responsibilities typically borne by homeowners. Mobile homes (Structure type 6) incur a lower average additional housing cost, reinforcing their affordability. Structures 4, 3, and 2 have incremental average additional costs in that order, indicating a potential correlation with the scale and features associated with these structure types

7. HOW DOES THE DISTRIBUTION OF ASSISTED HOUSING COMPARE BETWEEN DIFFERENT STRUCTURE TYPES? ARE SPECIFIC STRUCTURE TYPES MORE LIKELY TO RECEIVE ASSISTANCE?

Mult Unit Structures and Higher Assistance:

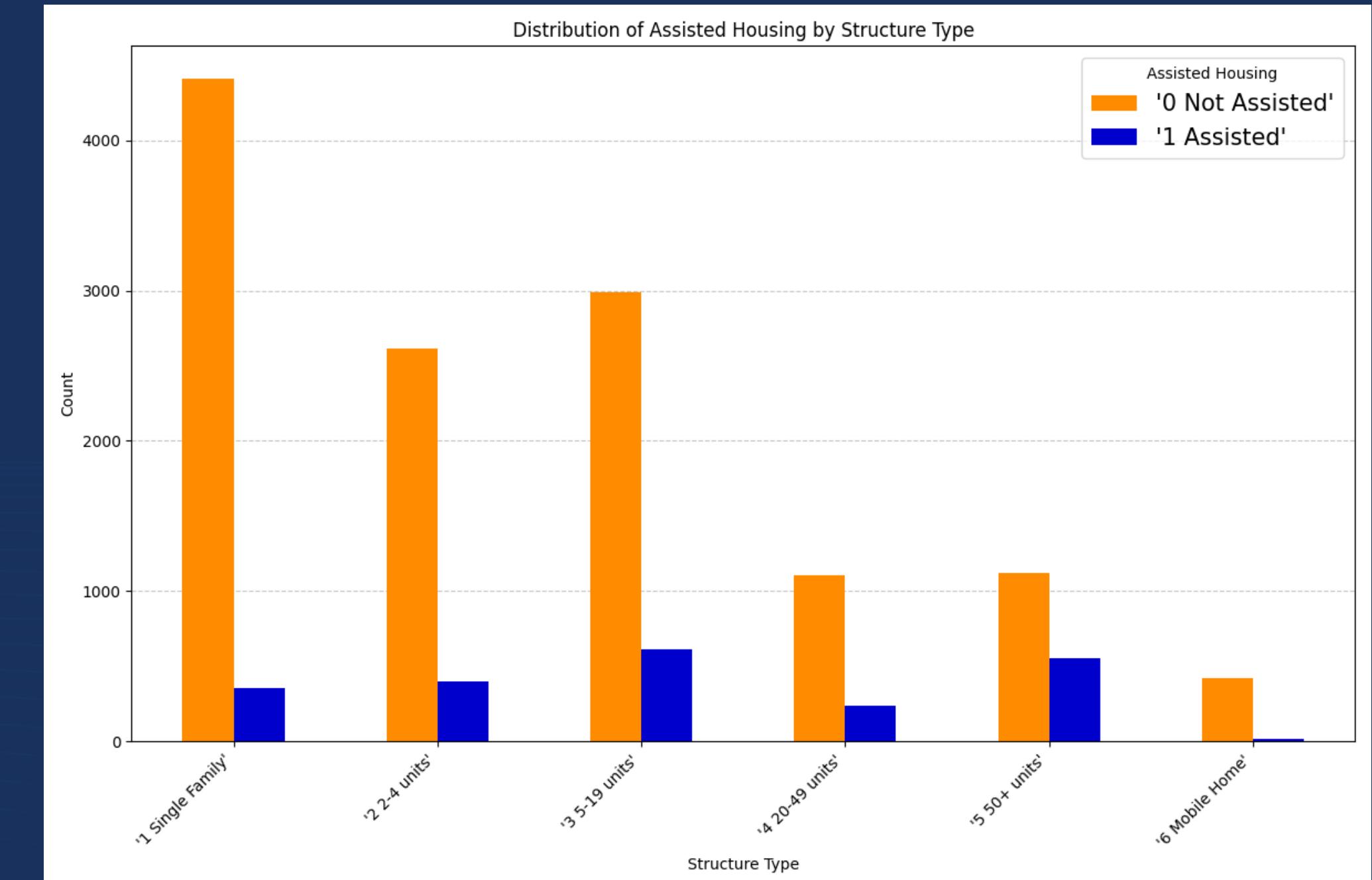
- Structure types 2, 3, 4, and 5, particularly structure type 3 ("5-19 Units") and structure type 5 ("50+ Units"), receive a higher distribution of assisted housing. This suggests that larger multifamily structures are more likely to benefit from housing assistance programs. The scale and communal nature of these structures may contribute to their eligibility for assistance.

Single-Family (1 Unit) Homes and Limited Assistance:

- Structure type 1, "Single Family," receives less assistance compared to its size and may reflect a lower prevalence of housing assistance programs for detached single-family homes. This aligns with the general perception that housing assistance programs often target multifamily or economically diverse housing developments.

Mobile Homes and Negligible Assistance:

- Structure type 6, "Mobile Home," receives minimal assistance, indicating that mobile homes are less likely to be supported by housing assistance programs. This could be due to the affordability of mobile homes, potentially placing them outside the primary focus of assistance initiatives.



8. HOW DOES THE DIFFERENCE IN COST RELATIVE TO MEDIAN INCOME VARY AMONG THE DIFFERENT HOUSING STRUCTURE TYPES?

Single-Family Homes and Income Disparities:

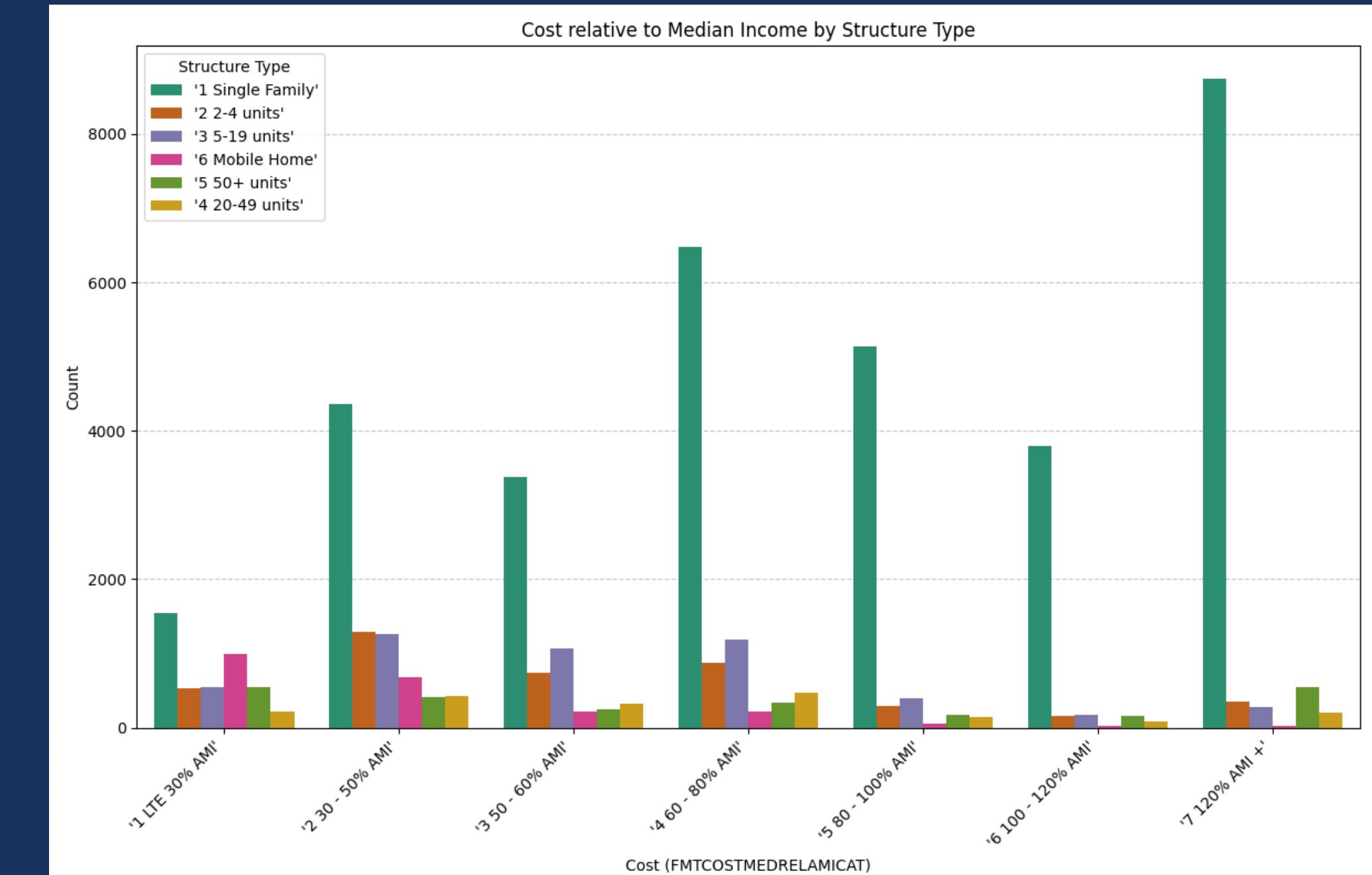
- Structure type 1, "Single Family," demonstrates a notable income disparity with the highest distribution in the top Average Median Income (AMI) category (120% AMI and above). This suggests that residents in single-family homes typically have higher incomes, potentially contributing to the higher housing costs observed earlier.

Multi Unit or Mobile Structures and Varied Income Distribution:

- Structures 2, 3, 4, 5 and 6 exhibit a different pattern, with higher distributions in the bottom four AMI categories. This indicates that residents in multifamily structures are more likely to have incomes in the lower to moderate range. The diversity in income distribution across these structures aligns with the varied nature of multifamily housing.

Income-Structure Type Dynamics:

- The observed differences in AMI category distributions highlight the dynamics between income levels and housing structure types. Understanding these dynamics can inform policies that aim to address income disparities and enhance housing affordability.



9. HOW IS THE DISTRIBUTION OF STRUCTURE TYPES CHANGING OVER THE YEARS IN TERMS OF CONSTRUCTION?

Structure Type 1 (Single Family) Lagging:

- Throughout the entire period, structure type 1, "Single Family," consistently had the lowest construction rates compared to other structure types. This could be indicative of a shift in housing preferences or urban planning policies favoring denser housing options

Early 20th Century Construction Trends:

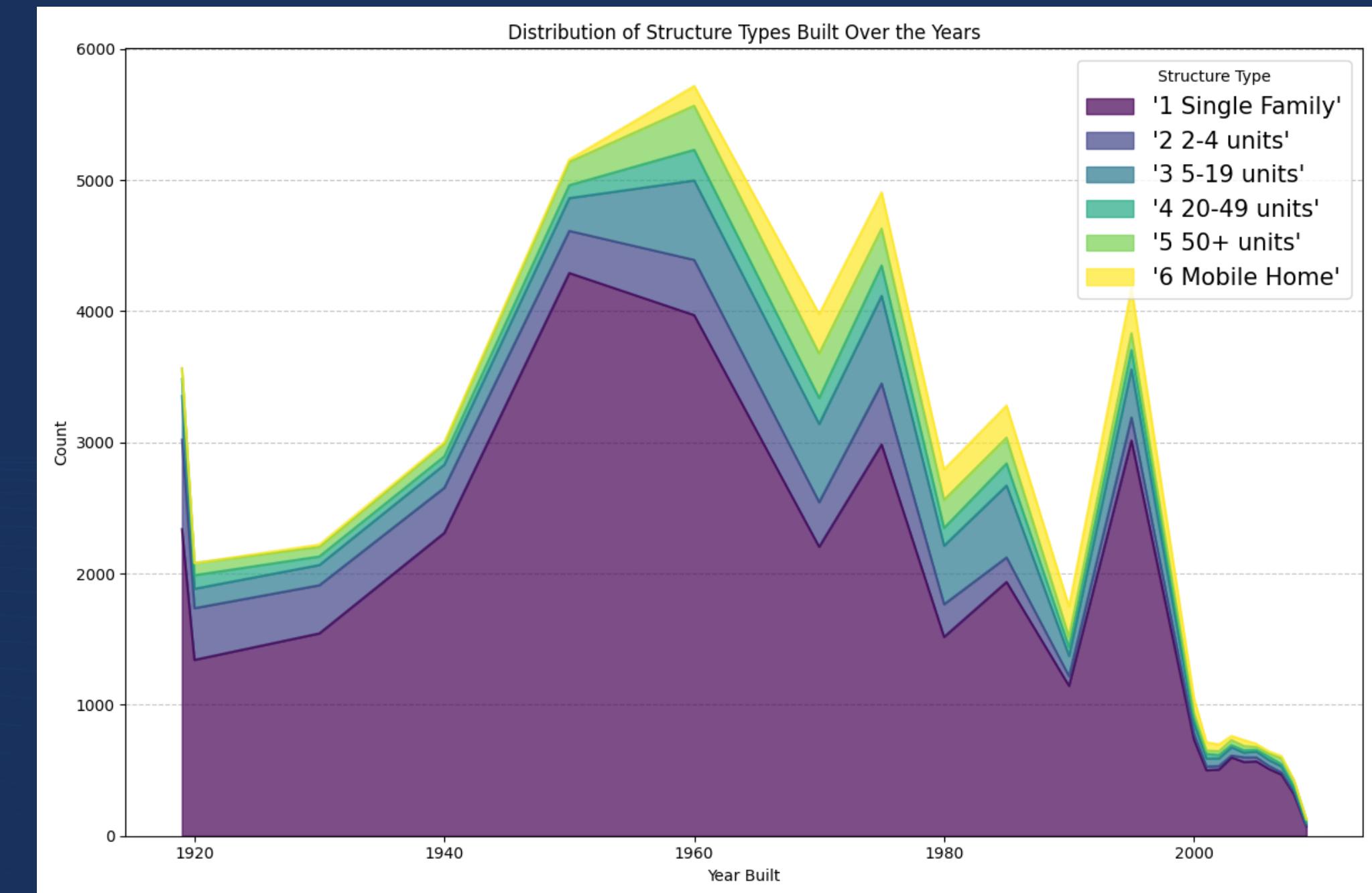
- From 1920 to 1960, all housing structure types experienced a similar increasing trend in construction. Structure types 5 (50+ Units) and 6 (Mobile Homes) were consistently constructed the most during this period, possibly reflecting the growth of multifamily dwellings and mobile home communities.

Fluctuations in the Late 20th Century:

- From 1995 to 2000, there was a subsequent surge followed by a decline. These fluctuations could be attributed to changing economic conditions, housing market dynamics, or policy interventions impacting the demand and supply of housing.

Overall Decline in Late Years:

- The trend in the late 20th century and beyond indicates an overall decline in the construction of various structure types. This decline might be influenced by factors such as economic recessions, demographic changes, or shifts in housing preferences.



THANKS

For Your Attention

REFERENCES: THE HOUSING AFFORDABILITY DATA SYSTEM (HADS)
DATASET: Housdata.csv FROM HADS