

Identifying the Affordable Housing Shortage: A Study for Oklahoma

Francesco Cianfarani , Shawn Schaefer , and Kalyan Mutukundu 

Christopher C. Gibbs College of Architecture, The University of Oklahoma, USA

Correspondence: Francesco Cianfarani (francesco.cianfarani@ou.edu)

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Abstract

The study provides an analysis of affordable housing in Oklahoma, US. Like the rest of the country, the state’s housing stock does not meet the affordable housing demand, especially for low-income households. The mismatch is currently aggravated by steady population and employment growth, rising housing costs, and a slowdown in housing construction due to high inflation. First, we introduce the topic with an overview of Oklahoma’s housing inventory, providing information on recurring development patterns and building types. We discuss main household characteristics and compare state-level data with national trends. Second, we analyze the gap between household demand and affordable housing supply across the state and its 22 core-based statistical areas. Using an algorithm running the Department of Housing and Urban Development and US Census Bureau datasets, the gap analysis evaluates household groups by income, comparing them to the distribution of housing units based on tenure, monthly housing costs, and unit size. The results are examined through a cluster analysis, which leads to the development of a classification of housing gaps across the state. We conclude by identifying the composition of the housing stock needed to address the mismatch between supply and demand and discuss policy implications. This research presents findings from a statewide housing needs assessment conducted by a cross-disciplinary team from the University of Oklahoma, and sponsored by the Oklahoma Housing Finance Agency, a state organization that offers affordable housing resources, including loans and rental assistance.

Keywords

affordable housing; cluster analysis; gap analysis; housing shortage; Oklahoma; US

1. Introduction

1.1. Problem

The shortage of affordable housing is a long-standing challenge in the US, historically concentrated in coastal areas. Recently, however, this problem has spread to the interior regions of the country (Badger & Washington, 2022). Factors such as rising construction costs, lagging household incomes exacerbated by the Covid-19 pandemic, inflation, and persisting barriers to new development—including restrictive zoning laws and NIMBYism—have been aggravating the mismatch between housing demand and supply, especially in the rental market (Joint Center for Housing Studies of Harvard University, 2023; McCue & Huang, 2024).

Several studies have discussed housing shortages at the national level, with a focus on low-income households (National Low Income Housing Coalition, 2024; Office of Policy Development and Research, 2023). Many have investigated the inefficiency of the housing system in large coastal cities such as New York (Ward et al., 2023), San Francisco (Hwang & Shrimali, 2021), and Los Angeles (Zhu et al., 2021). However, little has been studied on the housing market characteristics and affordability challenges in the US's central states. Therefore, an analysis of the housing affordability of Oklahoma—a landlocked state in the South-Central region of the US—offers an opportunity to document current US housing trends from the perspective of a non-coastal state. Indeed, Oklahoma exemplifies the characteristics of a traditionally rural region (Iowa State University, 2024), now experiencing economic growth and urbanization.

This study is part of an ongoing, comprehensive statewide housing needs assessment conducted by a team of faculty and students at the University of Oklahoma, and commissioned by the Oklahoma Housing Finance Agency (OHFA). OHFA is the state organization that manages public funds and resources to develop low-income rental housing, administering federal initiatives such as the Low-Income Housing Tax Credit (LIHTC) program—the nation's largest source of affordable housing financing—as well as rental assistance and homebuyers programs (Schwartz, 2021).

In this article, we present the methods and results of a gap analysis, a comparative tool used to calculate the mismatch between affordable housing supply and demand, investigating the housing shortage across the state and its 22 core-based statistical areas (CBSAs), including both metropolitan and micropolitan areas (United States Census Bureau, 2022). Additionally, we study these results through cluster analysis, grouping the examined geographies according to common housing market characteristics. We conclude by discussing policy implications to bridge the gap between supply and demand and determine the initiatives to meet the demand in the state.

1.2. Information on Case Study

Oklahoma has a population of 4 million people, grouped in approximately 1.5 million households, and a housing stock of about 1.7 million homes, with 34% of occupied units being rented (United States Census Bureau, n.d.). The median age of the state's housing stock is roughly 40 years, aligned to national data (United States Census Bureau, 2021c). When compared to the overall US housing inventory, Oklahoma's housing supply includes higher shares of single-family units—specifically detached single-family homes—as well as mobile/manufactured homes, revealing the state's predominantly rural and suburban culture

(Table S1, in Supplementary File). Small-scale multifamily structures, such as duplexes, triplexes, and fourplexes, are relatively uncommon and are mostly present in urban areas, particularly in Oklahoma City (OKC)—the state capital—and Tulsa, the two most populous cities in the state (United States Census Bureau, 2021e).

The median household size stands at nearly 2.5 people, with 29% of the state's households consisting of one person, closely mirroring national data (United States Census Bureau, n.d., 2021h). However, the physical characteristics of Oklahoma's housing stock do not parallel the state's demographic profile. Notably, 1.9% of the overall supply consists of no-bedroom units (studios), 8.8% are one-bedroom units, and 23.4% are two-bedroom units. Consequently, almost two-thirds of the state's housing stock (65.9%) comprises units with three or more bedrooms (United States Census Bureau, 2021d). According to the 2021 American Community Survey (ACS) estimates by the United States Census Bureau, Oklahoma's housing vacancy rate is 13.7%, 2.5 percentage points higher than national statistics. Similarly, a high proportion of the state's housing stock (7%) is classified by the Census as "other vacant"—a category including abandoned units, units in need of repair, properties in foreclosure, or units used as storage. The proportion of such vacancy type in Oklahoma is 3 points higher than national data, making it the 5th highest rate in the US. Approximately 237,800 units in the state are vacant, with 122,700 categorized as "other vacant" units (United States Census Bureau, 2021a, 2021b).

The state hosts 22 CBSAs, which include five metropolitan areas and 17 micropolitan areas. Together, these CBSAs house 85% of the state's population, with 61% concentrated in OKC and Tulsa metropolitan areas (United States Census Bureau, 2021e). Traditionally linked to the petroleum and agriculture industries, Oklahoma's economy increasingly relies on the transportation, government, and finance sectors, reflecting the economic development of neighboring Texas. Yet, in 2021, the state median household income was \$56,956, significantly below the national data of \$69,021, with approximately 15% of the population living in poverty (United States Census Bureau, 2021f, 2021g). Despite revealing lower incomes and higher poverty rates than national averages, Oklahoma has historically been one of the most affordable states in the US. According to the Census Bureau (Figure 1a), as of 2021, the state has one of the lowest rates of cost-burdened households in the US (United States Census Bureau, 2021d). Using Census estimates, Figure 1b illustrates changes in the percentage of cost-burdened households in the state from 2011 to 2021.

It is interesting to compare ACS estimates with statistics released by the US Federal Department for Housing and Urban Development (HUD) on housing affordability over the past decades. Table 1 shows Oklahoma's affordability level change from 2000 to 2020, categorized by tenure. According to HUD data, the percentage of cost-burdened households in 2020 was lower than 2010 rates for both renters and homeowners. However, when compared to 2000, 2020 rates are about 1.7 points lower for owners but almost 6.5 points higher for renters (Office of Policy Development and Research, 2024a). Such statistics reveal a widening gap between the number of cost-burdened homeowners and renters in the state over the past two decades. This gap was generated by increasing rental costs, as well as declining mortgage rates and tighter credit standards, particularly between the post-recession years and the Covid-19 pandemic. Moreover, as noted by literature at the national scale (McClure & Schwartz, 2024), Table 2 illustrates that the state's housing production boomed from 2000 to 2010, generating a surplus that persists to this day.

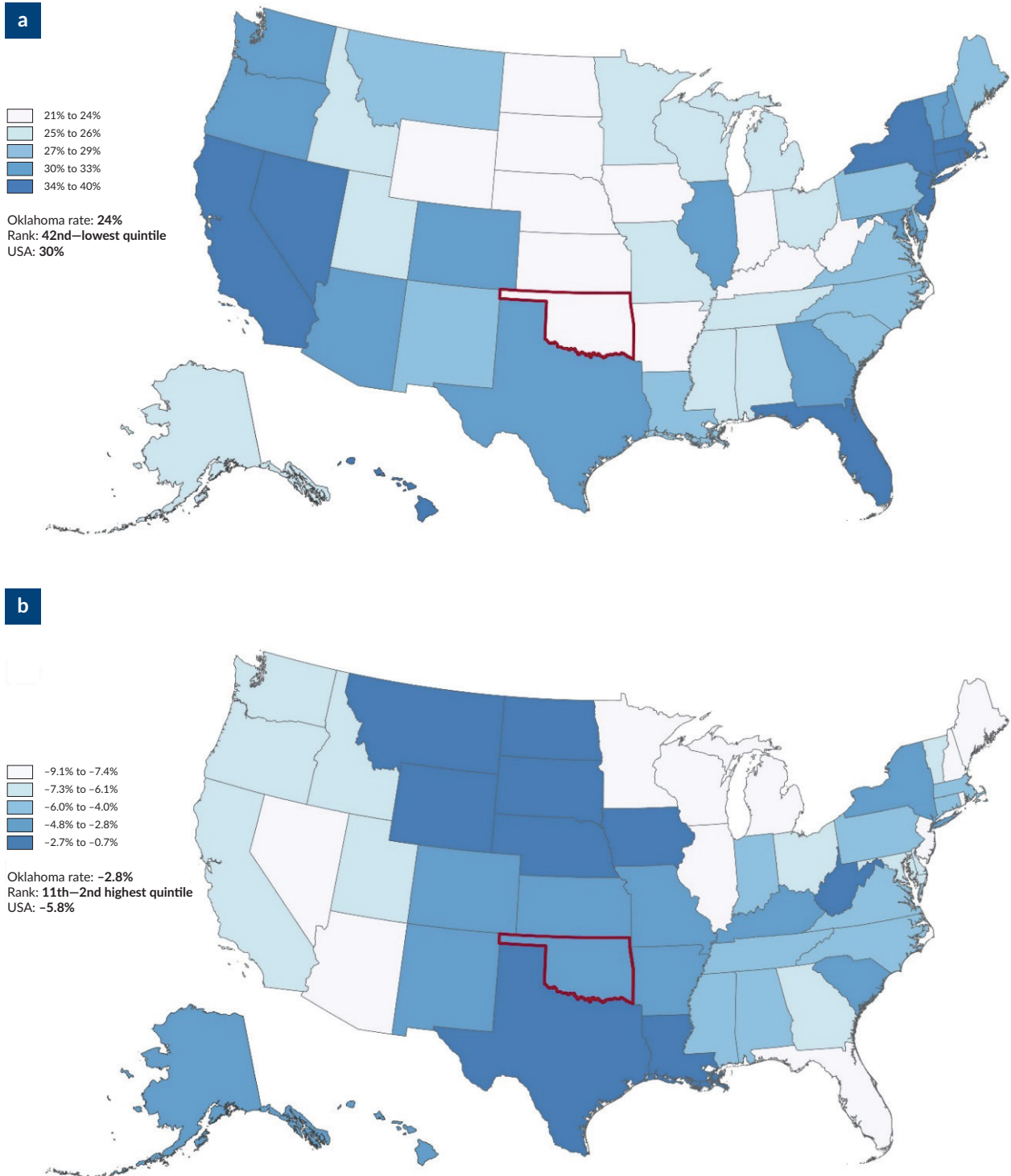


Figure 1. 2021 percentage of housing units with monthly costs greater than 30% of income by quintile in the US (a) and 2011–2021 percent change of housing units with monthly costs greater than 30% of income by quintile in the US (b). Note: Oklahoma is the state outlined in red. Source: United States Census Bureau, 2011, 2021d.

Table 1. Cost-burdened households in Oklahoma from 2000 to 2020.

Cost-burdened households in Oklahoma (2000–2020)	Year			Change in numbers and percentage points		
	2000	2010	2020	2000–2010	2010–2020	2000–2020
No. of households	1,341,891	1,421,705	1,493,570	79,814	71,865	151,679
No. of cost-burdened households	287,165	362,845	341,060	75,680	–21,785	53,895
% of cost-burdened households	21.40%	25.52%	22.84%	4.12%	–2.68%	1.44%
No. of renter households	423,771	451,745	507,015	27,974	55,270	83,244
No. of cost-burdened renter households	132,217	176,620	191,000	44,403	14,380	58,783
% of cost-burdened renter households	31.20%	39.10%	37.67%	7.90%	–1.43%	6.47%
No. of owner households	918,120	969,960	986,555	51,840	16,595	68,435
No. of cost-burdened owner households	155,162	186,230	150,065	31,068	–36,165	–5,097
% of cost-burdened owner households	16.90%	19.20%	15.21%	2.30%	–3.99%	–1.69%

Source: Office of Policy Development and Research (2024a).

Table 2. Housing units and vacancies in Oklahoma from 2000 to 2020.

Housing units and vacancies in Oklahoma (2000–2020)	Year			Change in numbers and percentage points		
	2000	2010	2020	2000–2010	2010–2020	2000–2020
No. of housing units	1,514,400	1,664,378	1,746,807	149,978	82,429	232,407
No. of vacant housing units	172,107	203,928	210,977	31,821	7,049	38,870
% of vacant housing units	11.36%	12.25%	12.08%	0.89%	–0.17%	0.72%
No. of on-market vacant units *	88,118	93,057	107,849	4,939	14,792	19,731
% of on-market vacant units *	5.82%	5.59%	6.17%	–0.23	0.58	0.35

Note: * On-market vacant units are all the vacant units for rent, for sale, rented-not-occupied, and sold-not-occupied, according to Census definitions. Source: United States Census Bureau (2000a, 2000b, 2010a, 2010b, 2020a, 2020b).

1.3. Federal and State Programs for Affordable Housing

Today, low-income housing in the US is mainly created by the private market through federal, state, and local government subsidies. On the demand side, federal programs managed by state agencies like OHFA provide vouchers to eligible low-income households, including the Section 8 Housing Choice Voucher Program, to help cover rental costs in the private market (Schwartz, 2021). More in detail, such rental assistance programs

require participating households to find a rental unit that meets program standards with a landlord who has agreed to accept the voucher. Households then pay a limited share of their monthly income for rent—about 30%—while the remaining rental costs are covered by local housing authorities using federal funds.

On the supply side, local public housing agencies no longer finance and build low-income housing solely as public entities, as they did in the past. Instead, they frequently form public–private partnerships to convert, manage, and maintain their housing stock. Consequently, only 1 million public housing units are available in the US today, accounting for approximately 0.7% of the country’s housing inventory (Fischer et al., 2021; United States Census Bureau, 2024). Most of the US public housing is located in neighborhoods with high poverty rates, often in need of maintenance, and under the threat of environmental hazards such as flooding (Urban Institute, n.d.).

In Oklahoma, OHFA has been managing the LIHTC program, which provides state agencies funds to issue tax credits for building, rehabilitating, or acquiring rental housing for low-income households (Schwartz, 2021). In 2024, OHFA started administering the Housing Stability Program, a state initiative that grants zero-interest loans to developers for building affordable for sale and rental housing (OHFA, 2024a). Local governments, including counties and municipalities, provide a range of housing programs, such as emergency rent and utility assistance. Cities also play a role in affordable housing, primarily through the administration of federal funds, such as the Community Development Block Grant, and the Home Investment Partnership Program, aiming at expanding the multifamily housing portfolio (Schwartz, 2021).

2. Methods and Data

2.1. *Methods for Calculating Affordability*

One of the core analyses we conduct for the assessment of housing demand and supply in the state is the gap analysis. This analysis is a macroeconomic tool that compares household income distributions with housing unit distributions based on monthly housing costs at a given point in time. The goal of a gap analysis is to identify household groups that lack affordable housing adequate to their income. While there is no international consensus on the definition of housing affordability, the US housing policy generally considers a home as affordable if a household spends no more than 30% of its gross income on housing costs, including payments for rent or mortgages, fees, or taxes, insurance, and utilities (Herbert et al., 2018; Joice, 2014; Jones et al., 1997; Stone, 2006). Our method for calculating the mismatch between affordable housing supply and demand refers to the 30% affordability threshold for both renters and homeowners.

Affordability thresholds determine the demand for different household income groups. For this analysis, we study household groups targeted by OHFA for rental assistance services, LIHTC programs, and first-time homebuyer loans. Since income levels vary periodically across geographies in Oklahoma, we establish median income thresholds using annual OHFA tax credit income and rent limit tables (OHFA, n.d.). OHFA tables are derived from HUD formulas that set an Area Median Family Income Limit (HAMFI) for each statistical area in the US, based on household size. Therefore, to ensure accuracy in our analysis, we use HAMFI values corresponding to each geography’s median household size. We then calculate the number of units affordable to each household income group, by summing units with housing costs below their affordability threshold (Office of Policy Development and Research, 2024b; OHFA, n.d.).

We structure the gap analysis around three major assessments. First, for the housing supply assessment, we examine all the units on the market, as classified by the ACS estimates from the Census Bureau. For rental units, this includes no-cash rent units and on-market vacant homes, such as vacant-for-rent units and rented-not-occupied units. Similarly, for owner-occupied units, we consider on-market vacant homes, which encompass on-sale units and sold-not-occupied units. Second, for the demand assessment, we assume that the number of households matches the overall housing demand. Thus, the housing demand assessment does not comprise the homeless population—approximately 4,000 individuals in the state (Office of Community and Planning Development, 2023)—as well as the relatively few, but growing cases, of households sharing a dwelling unit, particularly in large metropolitan areas (Office of Policy Development and Research, 2021). Once units and households are calculated, we compare them to determine whether there is a surplus or gap. A surplus of affordable housing exists if the overall supply in each housing cost group exceeds the number of households in each income group. Conversely, there is a gap if the demand exceeds the supply.

2.2. Data Aggregation and Datasets

Building on methods drafted by recent regional housing needs assessments (Mid-America Regional Council, 2023; URBNRX & Community Builders Network, 2021), we have developed two types of gap analysis that share calculation formulas, assumptions, and datasets but differ in the level of the data aggregation employed.

The first type, which we refer to as the “aggregated gap analysis,” calculates the mismatch between housing supply and demand according to tenure and income groups only. We apply this analysis to the state as a baseline for our considerations. Given that a statewide gap or surplus may hide significant variations among local markets, we also apply this analysis to all the state’s CBSAs. Figures 2 and 3 below illustrate the aggregated gap analysis algorithm for rental and owner-occupied units.

For the second type of analysis, defined as the “disaggregated gap analysis,” we focus exclusively on the rental housing market for both the state and its CBSAs. We calculate the mismatch by income groups and unit types categorized by number of bedrooms—no-bedroom, one-bedroom, two-bedroom, and three-or-more-bedroom units—to define the types of rental homes most needed in the market, according to unit size.

Figure 4 presents the flowchart detailing the process used in the disaggregated gap analysis, while tables S2 and S3 in the Supplementary File list the datasets with raw data used for both gap analyses. When we developed the gap analysis in July 2023, the latest Census Bureau and HUD datasets were updated to 2021.

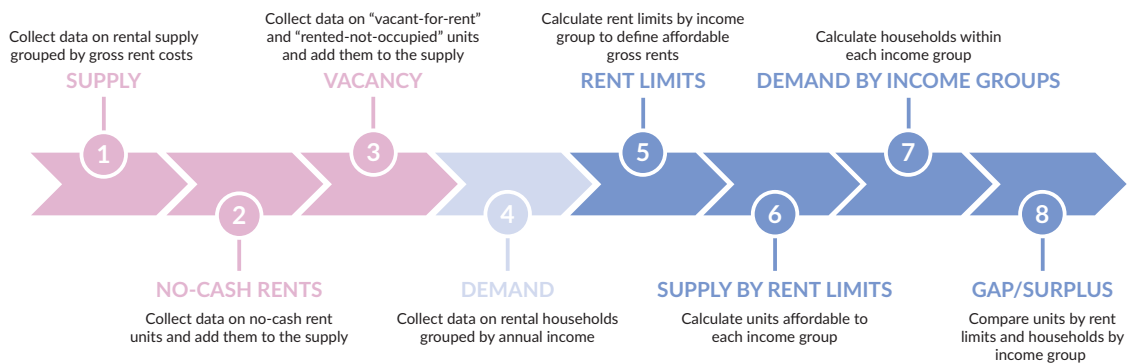


Figure 2. Workflow for aggregated gap analysis (rental housing).

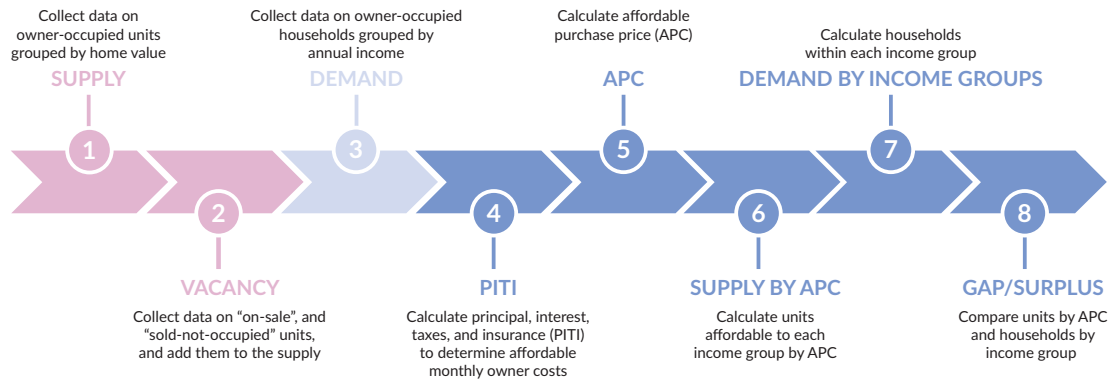


Figure 3. Workflow for aggregated gap analysis (owner-occupied housing).

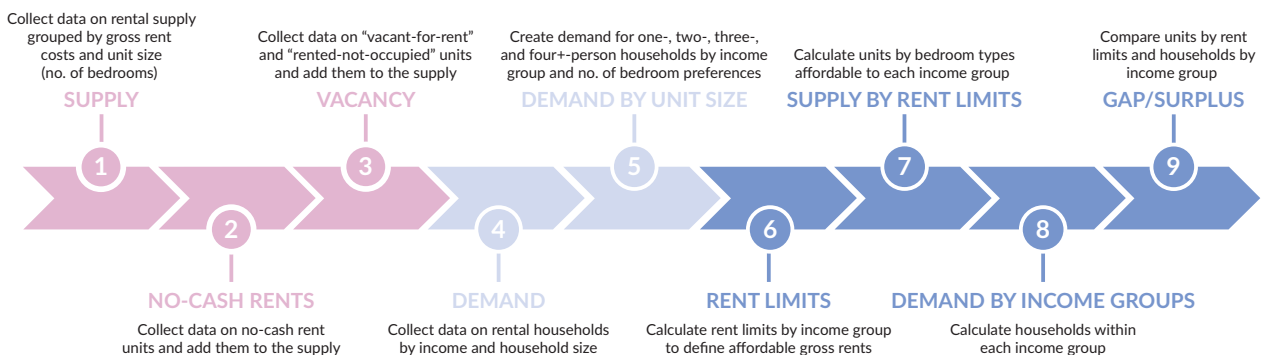


Figure 4. Workflow for disaggregated gap analysis (rental housing).

2.3. Assumptions

For our calculations, due to the complexity of the phenomenon analyzed, we have established assumptions, summarized as follows: First, we identify housing demand with the total number of households and supply as the total number of occupied units plus on-market vacant homes. A unit is considered affordable if a household spends no more than 30% of its pre-tax income on housing costs, which are gross rent costs for renters and PITI for homeowners. Affordability thresholds vary across CBSAs, with a state average for affordable gross rent and affordable purchase price for a middle-income household of about \$1,400 and \$195,000.

We classify household groups according to the following income levels: households earning less than 30% of HAMFI (roughly equivalent to the poverty level), or extremely low-income (ELI) households; households earning between 30% and 50% of HAMFI, or very low-income (VLI) households; households earning between 50% and 60% of HAMFI, or VLI households, calculated as the upper limit for income eligibility to LIHTC programs (VLI-LIHTC); households earning between 60% and 80% of HAMFI, or low-income (LI) households; households earning between 80% and 100% of HAMFI, or moderate-income (MI) households; households earning between 100% and 120% of HAMFI, or middle-income (MIDI) households; households earning more than 120% of HAMFI, or high-income (HI) households. All these seven income levels are considered in the aggregated gap analysis. Due to data availability, for the disaggregated gap analysis we cannot calculate the rental housing mismatch for MI, MIDI, and HI households. Thus, we combine them into a single household group, defined as households earning more than 80% of HAMFI (LI+). Additional assumptions for the gap analysis are reported in Table S4, in the Supplementary File.

3. Results

3.1. Major Surpluses and Shortages Identified

Our analysis focuses on establishing a baseline, running first an aggregated gap analysis for the entire state. Overall, the aggregated gap analysis shows a surplus of units. This is expected for real estate markets examined as a whole. However, as anticipated by national academic studies and regional assessments on the topic, our results reveal a clear mismatch between household income and housing cost distributions (McClure & Schwartz, 2024; Mid-America Regional Council, 2023; URBNRX & Community Builders Network, 2021).

Starting from rental housing, there are more affordable units than households at all but the lowest and highest costs. As most of the rental housing stock concentrates within the 30% and 80% of HAMFI, we find a significant mismatch at the ends of the income spectrum, for both ELI and MIDI households and higher. Specifically, only 7.70% of Oklahoma's overall 560,844 rental housing units are affordable to ELI households. Approximately 30% of the rental market is affordable to households earning less than 50% of HAMFI, while almost 76% is affordable to households earning less than 80% of HAMFI. A notable gap—71,268 units—is for ELI households seeking rent below \$427. As a result, about 62% of ELI renter households in Oklahoma occupy units that are unaffordable for their income. Similarly, there is a deficit of 86,240 rental units for households earning more than 120% of HAMFI. Although this mismatch at the high end of the income spectrum does not truly represent a shortage—as higher-income households can afford housing at lower income levels—it indicates that over 74% of HI households occupy rental units affordable to lower-income households. Consequently, this condition further reduces the availability of affordable housing for lower-income groups.

We observe similar patterns when analyzing the rental housing gap at the CBSA level. All the 22 metropolitan and micropolitan areas surveyed show a housing shortage for ELI renters. The percentage of demand met for this income group significantly varies across CBSAs, ranging from low rates (Stillwater, 17%) to very high proportions (the rural area of Woodward, 98%), with an average rate of 42% excluding outliers. Interestingly, the three most unaffordable geographies in the state for ELI renters include very diverse CBSAs, such as the micropolitan areas of Stillwater (a college town, home of the Oklahoma State University), Durant (a fast-growing suburban area gravitating around the Dallas-Fort Worth region), and the metropolitan area of OKC. Similarly, shortages are recorded for rental households earning less than 50% of HAMFI. Out of the 22 CBSAs, 12 do not have enough affordable supply for rental households earning less than the VLI threshold. As registered at the state level, we find a shortage of affordable rental housing for MIDI households and higher across all the CBSAs, except for the micropolitan area of Stillwater. Shortages are not registered for LI rental markets and are rare for MI rental households. Only four CBSAs—all small rural micro areas—reveal a gap for MI households.

For owner-occupied homes in Oklahoma, out of 1,023,740 units, around 14% are affordable to ELI households. Almost 30% are affordable to households earning less than 50% of HAMFI, while 52% are affordable to households earning less than the LI threshold. The state has a housing gap only for HI-owner households. Yet, such a mismatch is significant, as the number of units affordable exclusively to HI households is less than one-half of the demand. Further proof of the gap for owner-occupied housing towards the higher income end is the limited surplus of owner-occupied units for MIDI—1,143 units,

exceeding the demand by only 1.3%. Interestingly, there is a surplus of owner-occupied units for lower-income households, probably due to high rates of aging properties and mobile/manufactured homes in the market. However, members of this group may struggle to acquire credit and save for a down payment of a unit. As a result, lower-income owner households may be forced into the rental market, which is already tight. This could lead to cost burdens, overcrowding, and exposure to unhealthy living conditions. In some cases, homelessness may be the result.

Findings for CBSAs are consistent with state results. All the CBSAs show a shortage of affordable owner-occupied homes for HI households. However, compared to state data, we find an exception for MIDI households. Differently from state results, we identify a housing gap for households earning between 100% and 120% of HAMFI in 12 micropolitan areas.

Vacancy does not significantly impact the gap analysis at this scale. While including on-market vacant units in the housing supply calculation increases the surplus, there are no significant changes from gaps to surpluses across income groups once these units are added. The only notable exception is registered at the state level for the MIDI owner-household group, where we found a surplus turning into a shortage once we excluded vacant homes from the supply. Note that the state's rate of on-market rental vacant units is 8.98%. For CBSAs, rates range significantly, from 4.34% to 19.25%. Similarly, vacancy rates for owner-occupied housing vary for CBSAs, from very low (0.77%) to high rates (12.61%), with a state rate of 2.96%. Figures 5a and 5b present a series of bar charts displaying the aggregated gap analysis results for the state, showing demand, supply, and mismatches by income levels for both rental and owner-occupied housing.

The disaggregated gap analysis provides details on rental housing affordability in relationship to units by number of bedrooms. We run this second examination to have a more nuanced idea of the gap for rental housing by considering the variables of unit and household sizes.

As shown in Figure 6, statewide, the demand for studios and, especially, one-bedroom units exceeds supply. We find a housing surplus of such units only for households earning between 30% and 60% of HAMFI. In contrast, the supply of two-bedroom units exceeds demand, except for households earning less than 30% and more than 80% of HAMFI. Similarly, the supply of three or more-bedroom units exceeds demand, except for households earning less than 30% of HAMFI. Among all categories, the highest demand is for one-bedroom units for households earning more than 80% of HAMFI (approximately 78,500 households). However, the highest supply in the market is for three or more-bedroom rental units affordable to households earning more than 80% of HAMFI (around 95,000 units). This is likely due to the large number of detached large single-family homes offered for rent in the state.

At the CBSA level, all income groups assessed, we find a gap for studios in 19 out of 22 metropolitan and micropolitan areas. While there is a mismatch of one-bedroom units across all CBSAs, we always register a surplus of two-bedroom and three-or-more-bedroom units. This significant discrepancy between demand and supply aligns with national trends of shrinking household sizes and a growing preference for smaller rental units, also due to affordability concerns (Joint Center for Housing Studies of Harvard University, 2023).

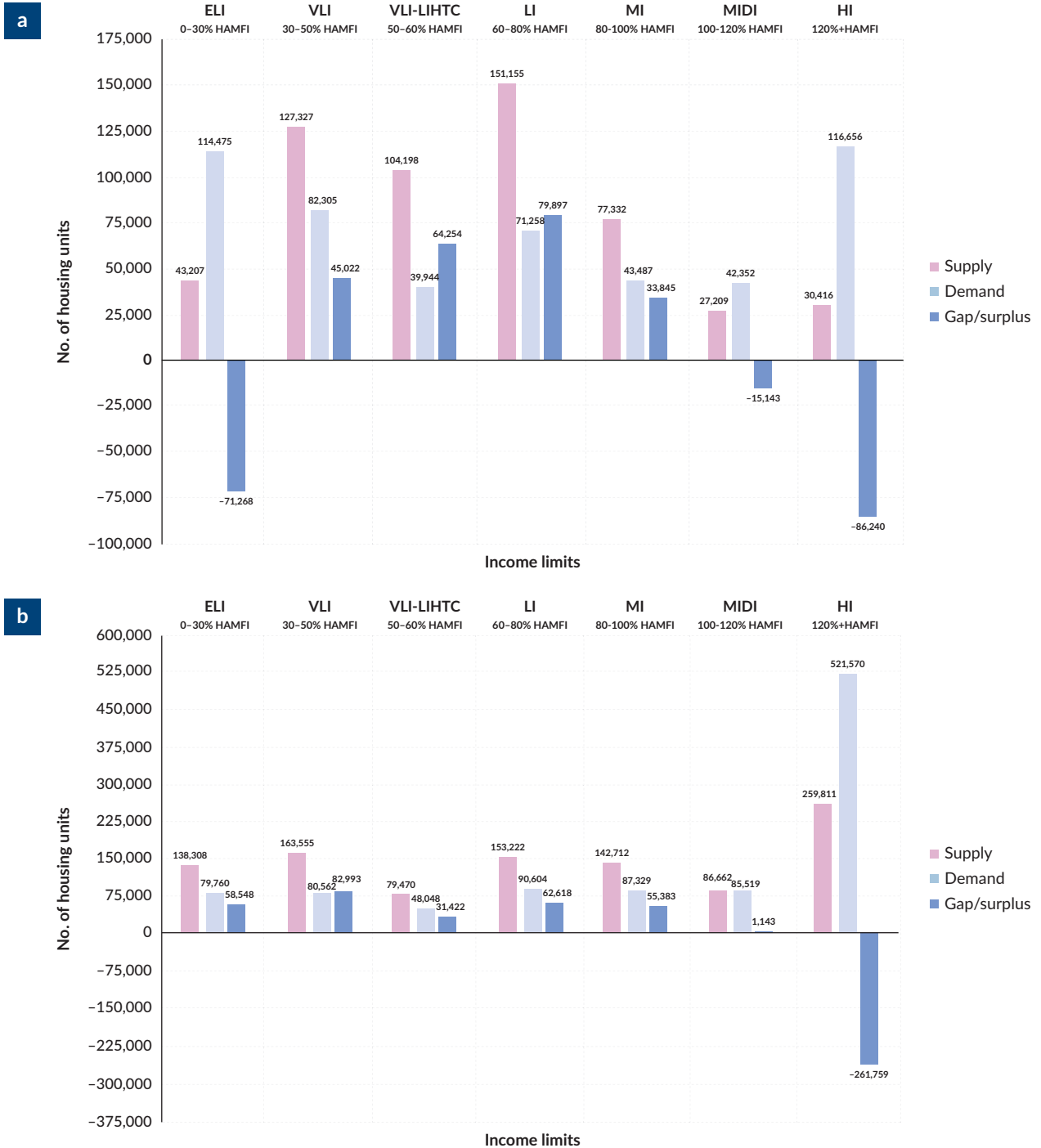


Figure 5. Aggregated gap analysis results for the state of Oklahoma (rental housing) (a) and Aggregated gap analysis results for the state of Oklahoma (owner-occupied housing) (b). Notes: The x-axes in the graphs represent the income levels, while the y-axes denote the number of units; for each bar, the numbers shown represent, respectively: the total of housing units in the respective housing cost group (supply bar), the total of households in the corresponding income group (demand bar), and the surplus or gap in units (gap/surplus bar).

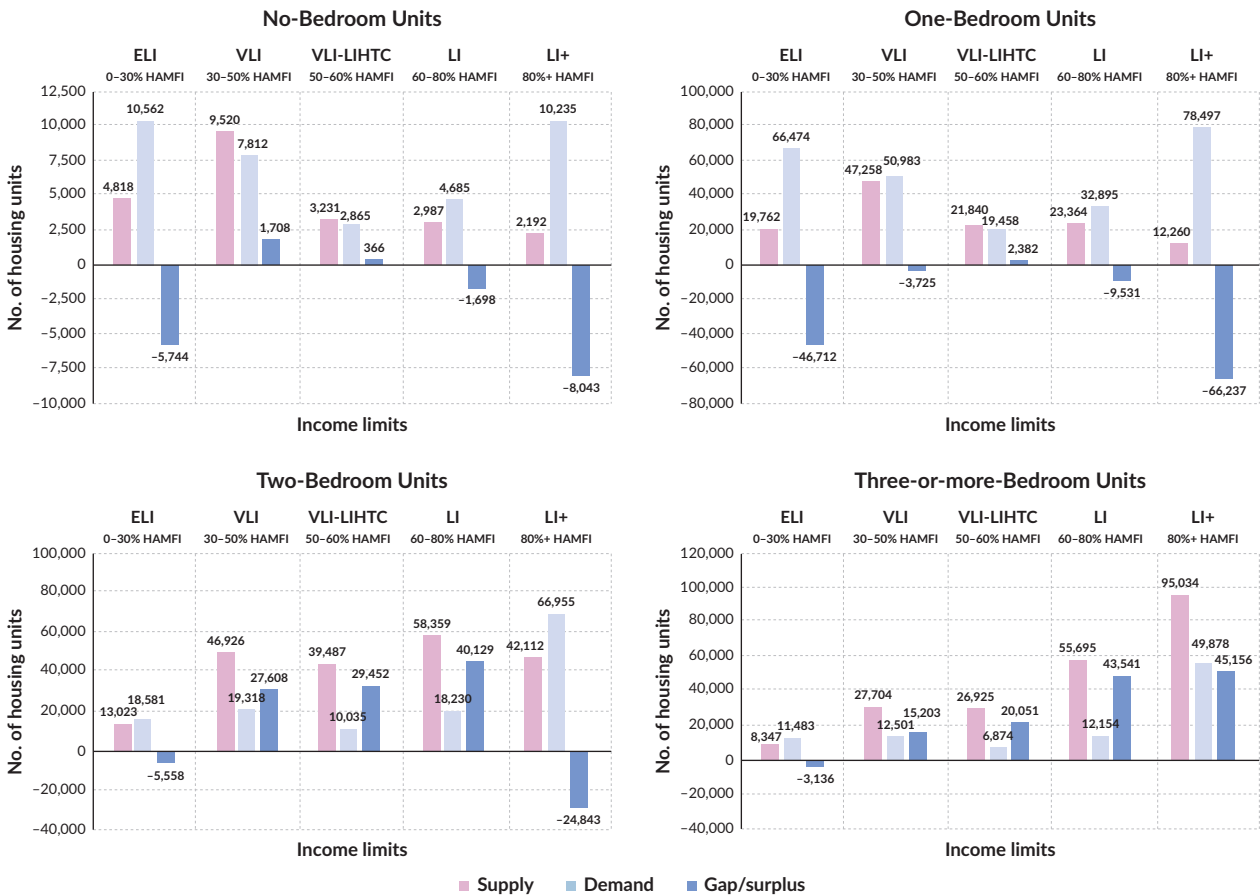


Figure 6. Gap analysis results for the state of Oklahoma by number of bedrooms (rental housing only). Notes: The x-axes in the graphs represent the income levels, while the y-axes denote the number of units; for each bar, the numbers shown represent, respectively: the total of housing units in the respective housing cost group (supply bar), the total of households in the corresponding income group (demand bar), and the surplus or gap in units (gap/surplus bar).

3.2. Clustering

To further investigate the results of the gap analysis, we perform a cluster analysis. This examination aims to look for geographic patterns of housing demand and supply across Oklahoma. If clusters are identified, they can be described and used to characterize specific needs and targeted policy approaches. Indeed, the gap analysis is a macroeconomic tool that does not capture the main similarities and differences in demand and supply across CBSAs.

Therefore, for the cluster analysis, we collect key affordability indexes resulting from the gap analysis, such as the median home value to median income ratio, the median gross rent to the median monthly income ratio, and the percentage of affordable units to total units for LI households. We then compare them to typical demand and supply indicators. For demand clustering, we use data on population, and percentages of household change, income change, and employment change over 10 years (2011–2021). For supply, we analyze rental and ownership supply elasticity over the same period, as well as vacancy rates and diversity indexes.

A diversity index is a measure of heterogeneity that considers the number of categories analyzed and the relative abundance of each category. This index calculates the probability that two randomly selected observations within an area will be of the same type. Diversity indexes can capture the mix of housing types in a given area, as well as unit types by the number of bedrooms (Chakraborty & McMillan, 2022). For our cluster analysis, we use the Simpson Diversity Index to evaluate the variety of units by bedroom count in each CBSA.

The list of supply, demand, and affordability indicators, along with their corresponding datasets, is reported in Table S5 of the Supplementary File. We use IBM SPSS Statistics software for calculations and testing different clustering techniques, including K-means and hierarchical clustering. Additionally, we run multiple trials setting a different number of clusters to determine the optimal number that could summarize the key differences in the state’s housing market. Ultimately, we opt for Ward’s method with hierarchical cluster analysis and squared Euclidean distance, as it provides the most consistent results in relationship to our knowledge of the study area.

The dendrogram reported in Figure 7 displays the results of the analysis with a possible cut-line, which identifies three clusters and an outlier corresponding to the micropolitan area of Stillwater. We adopt the

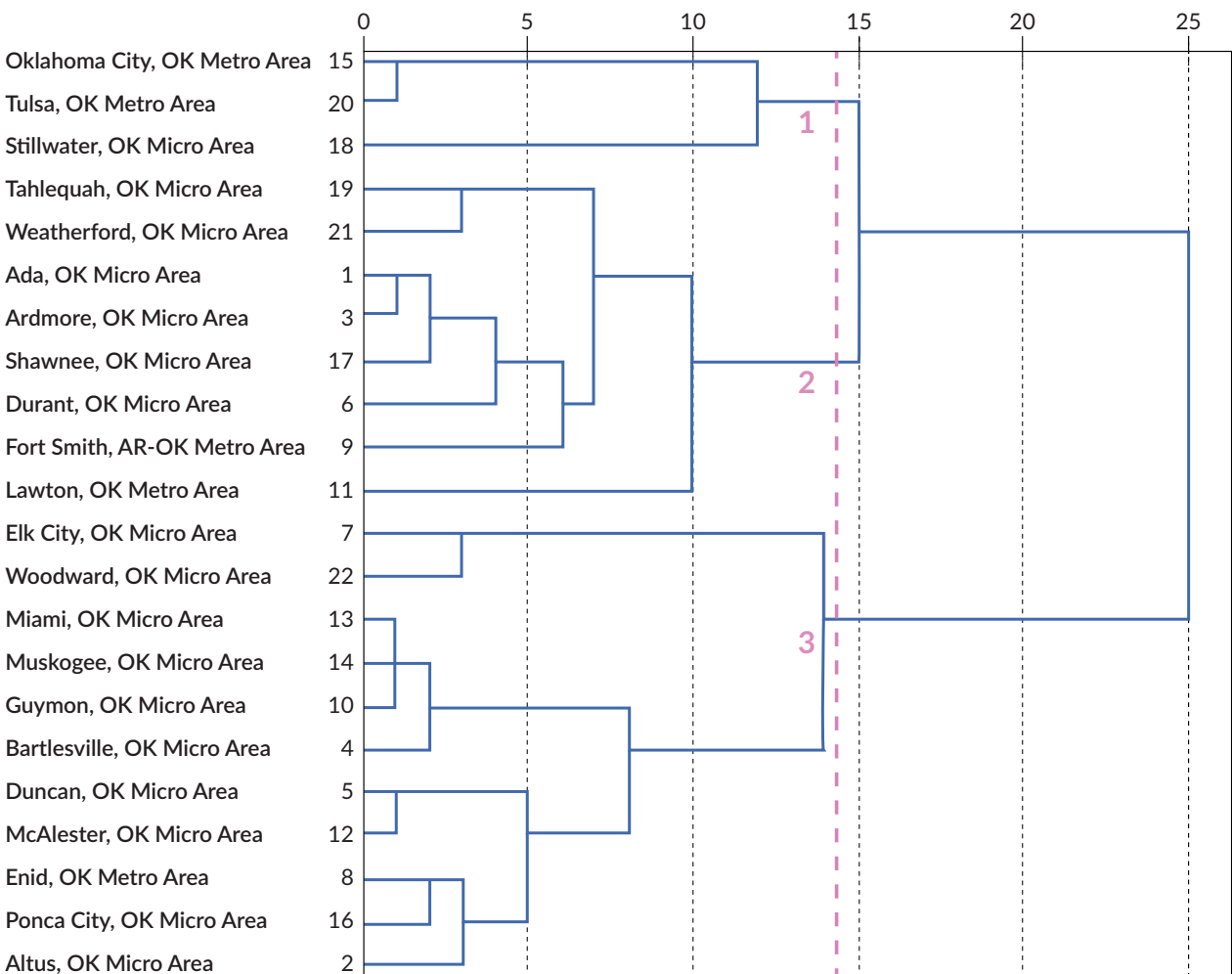


Figure 7. Dendrogram with Oklahoma’s CBSAs clustered according to the proposed cut-line.

division into three clusters and assign the outlier to the closer cluster, considering its unique geographic, economic, and social characteristics. We name the clusters by their proximity to the main urban centers of the state—OKC and Tulsa—as follows: *Central Cities*, *Adjacent Centers*, and *Rural Outposts*. Table S6 in the Supplementary File lists the cluster memberships for all the examined CBSAs, while Figure 8 illustrates the three clusters on a state map, providing a geographic interpretation of demand, supply, and affordability indicators from the gap analysis. The map reveals how different economic patterns and urbanization phenomena coexist within Oklahoma. In particular, the cluster analysis clearly distinguishes two *Central Cities* from the other CBSAs. These two metropolitan areas include Oklahoma’s five most populated cities—OKC, Tulsa, Norman, Broken Arrow, and Edmond—and feature the state’s highest household and employment growth rates. *Central Cities* are characterized by an inelastic market, especially for ownership, which limits the access and affordability of owner-occupied housing. Additionally, on average this cluster reveals lower rental affordability indexes for lower-income households when compared to the other two clusters in the state. Such data are somewhat balanced by a more diverse housing stock and healthier lower vacancy rate than the state average—approximately 10%.

The *Adjacent Centers* cluster comprises predominantly metropolitan and micropolitan areas located along major interstates and highways—such as Lawton, Enid, Stillwater, and Shawnee—in proximity to the two *Central Cities*. Exceptions include the micropolitan areas of Ardmore and Durant, close to the southern border adjacent to Texas, within a 100-mile distance from the fast-growing cities of Dallas and Fort Worth. *Adjacent Centers* reveal higher household, income, and employment growth rates than the state average.

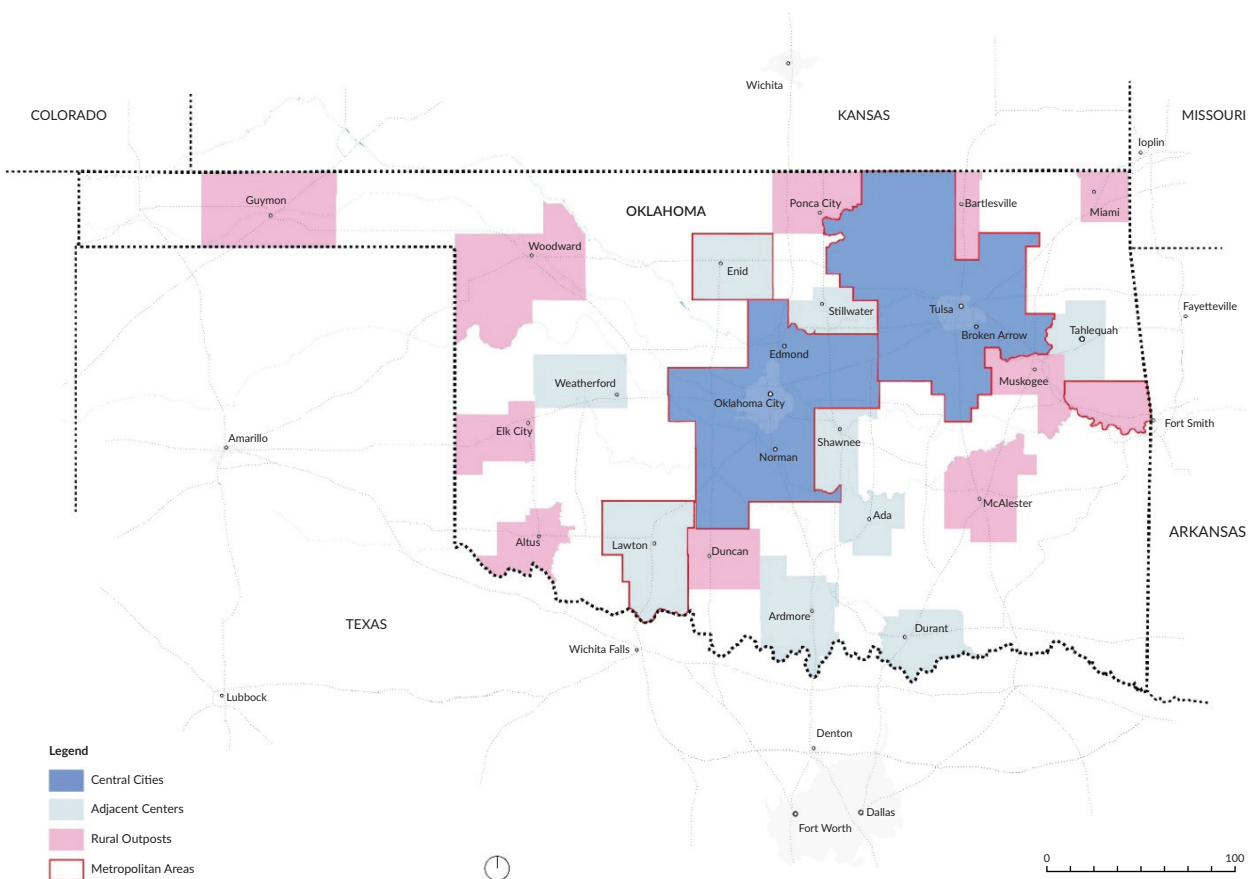


Figure 8. The geographic location of the state’s CBSAs (grouped in three clusters).

Additionally, they show lower rental and owner-occupied housing elasticity than the state average and a more unaffordable ownership market for LI households. Finally, unlike the *Central Cities* cluster, the *Adjacent Centers* present a higher proportion of single-family housing supply, and larger units, resulting from higher housing diversity indexes.

The *Rural Outposts* cluster presents a declining population, stable income levels but job losses, and a homogenous aging housing stock, mostly comprised of standalone single-family houses and mobile/manufactured homes. The *Rural Outposts* CBSAs are the most affordable in the state, showing higher vacancy and supply elasticity rates when compared to the *Adjacent Centers*. Geographically, these areas are scattered, mostly located on the outskirts of the state.

4. Conclusions and Policy Implications

4.1. Key Findings

Oklahoma's rental housing market is squeezed from both ends of the household income spectrum. As most of the rental housing stock across the state falls within 30%–80% of the HAMFI range, there is a gap in affordable rental housing for ELI, MIDI, and HI households. Approximately 62% of ELI households in Oklahoma occupy units unaffordable for their income, while over 74% of HI households rent units affordable to lower-income households, creating pressure on lower-income market segments. The mismatch is more severe for rental studios and particularly for one-bedroom units, reflecting national trends in housing availability. Results for CBSAs offer a more nuanced assessment than state data, as they additionally show rental housing shortages for households earning less than 50% of HAMFI (in more than half of the analyzed geographies) and MI households (in four micropolitan areas). There is sufficient affordable owner-occupied housing in the state from the ELI to the MI levels. The surplus for MIDI households is tight, while there is a significant gap for HI households.

Through cluster analysis, we identify three distinct housing submarkets in Oklahoma. Besides the growing urban areas of OKC and Tulsa, we found stable CBSAs near the major centers of the state and the Dallas-Fort Worth area. The remaining micropolitan areas are mostly characterized by population, employment, unit loss, and high vacancy rates. These clusters show the multifaceted nature of Oklahoma's housing market, characterized by simultaneous phenomena of economic growth, stagnation, and decline.

4.2. Limitations to the Study

While this study offered a comprehensive analysis for calculating and interpreting housing mismatches, there are limitations worth noting.

The first set of limitations pertains to data. To align all the demand and supply datasets used in the project to a similar timeframe, we used statistics updated to 2021. However, much of these data were collected during the Covid-19 pandemic, which may not accurately reflect the current state of Oklahoma's economy, particularly in demand categories such as employment. Another limitation is that most of the supply and demand datasets were provided by Census and HUD in aggregated form rather than disaggregated raw data. Consequently, for the gap analysis, we adopted assumptions related to the data distribution of households and unit groups to

align the Census and HUD data groups to the household and income categories defined by OHFA. Moreover, while reasonable in 2021, some assumptions may now be outdated. For instance, we assumed lower mortgage interest rates than current rates to calculate monthly housing costs for measuring the gap of owner-occupied housing. The significant increase in interest rates since 2021 has resulted in a more conservative analysis of the owner-occupied housing gap compared to today, especially for MIDI households.

A second group of limitations relates to the adopted method. First, to calculate the housing mismatch, we assumed that all households within a given income range could afford all units identified as affordable for that range. However, this assumption does not recognize that households at the lower end of an income range may not be able to afford homes that are only affordable to those at the higher end. As a result, our estimates should be considered conservative. Second, for this project, we focused on the concept of housing affordability only. Due to a lack of accessible and updated data, we could not assess the availability of affordable homes in the state. The literature typically defines available, affordable housing as the number of units affordable, vacant, or occupied by households with income less than or equal to the income threshold in question (Joice, 2014). According to research on housing affordability in the US, such as the periodic *The Gap* reports by the National Low Income Housing Coalition, the shortage of affordable housing—especially for the lowest-income renters—becomes even more severe when availability is considered (National Low Income Housing Coalition, 2022). Indeed, tight housing markets often result in higher-income households occupying homes affordable to lower-income households, thereby further reducing the supply of available affordable housing for lower-income groups.

The geographic level of analysis provides a final important caveat to discuss. As recently noted by the literature (Freemark, 2024; McClure & Schwartz, 2024), there are limitations when the shortage of affordable housing is investigated at the CBSA scale. Indeed, metropolitan and micropolitan areas can present significant variations in terms of housing supply and demand within the same geography. These variations are influenced by uneven access to jobs and transportation, as well as differing levels of housing quality and desirability. However, an underpinning principle of urban economics is that cities are primarily labor markets, as modern labor is highly mobile and metropolitan areas compete for workers. Within these labor markets, commuting distance or commute time from workplaces determines the primary housing market areas. Smaller areas, while useful for the valuation of properties, are not particularly well-suited for market area comparison.

4.3. Policy Implications

The Oklahoma housing market is not homogenous. Cluster analysis reveals significant differences between rural, suburban, and urban trends. Subtle differences exist in rural areas with larger towns in micropolitan areas or with proximity to metropolitan areas diverging from more remote agricultural areas. A statewide housing policy should have provisions that adapt to differences between clusters.

The findings of this research indicate that in all the state's CBSAs, the housing problem is strongly related to a mismatch between household incomes and housing costs. Therefore, policymakers should consider increasing public funds to address this mismatch. For rental housing, programs supporting the demand of lower-income households to bridge the gap between incomes and rents should be expanded, starting from the cluster where the proportion of affordable housing for lower-income households is below the state average, such as the

Central Cities cluster. As most of the stock today is in the 30%–80% of HAMFI pricing range, policymakers should contemplate expanding the Housing Choice Voucher program to all the lower-income households who qualify. Currently, only a fraction of qualified households receive vouchers, due to funding limitations of the program.

The rental market in Oklahoma is also squeezed from the upper end of the income spectrum, as few higher-rent units are built because higher rents are close to the costs of owner-occupied units. Meanwhile, the availability of owner-occupied units may be limited because many are occupied by households that could afford to upsize or, most likely, downsize but choose not to due to low diversity in supply. Therefore, alternative types of both rental and owner-occupied units are needed to better meet households' expectations. Especially in the *Central Cities* and *Adjacent Centers* clusters, relaxing zoning ordinances and creating flexible development standards can help diversify the housing stock to better meet the demand for both rental and owner-occupied housing.

Another group of solutions to the affordable housing problem in Oklahoma should focus on maintaining the existing supply. Housing needs and desires are not always concomitant with increased demand in housing markets. For instance, regions may have an aging housing stock in need of renovation or replacement. This need may be addressed when population and employment decrease and incomes stagnate. Understanding the characteristics of these units is key information for assessing innovative solutions to a more affordable housing market, especially in geographies in the *Rural Outposts* cluster.

Finally, given the data from most of Oklahoma's CBSAs, community leaders should identify programs to tackle housing vacancies. Specifically, one of the primary goals for these initiatives should be reclaiming vacant units held off the market but still suitable for occupancy. Recognizing that homeownership implies both rights and responsibilities towards the public, these programs should incentivize the reuse of off-market vacant homes through a balanced combination of rewards and penalties. Incentives could include, for example, economic benefits like low-interest loans for homeowners who commit to renovating and bringing their vacant properties back into the affordable housing market. Conversely, penalties, such as higher property taxes for long-term vacancy, could encourage homeowners to sell or rent.

The breadth of these considerations suggests that achieving affordable housing in a state like Oklahoma requires a comprehensive strategy that encompasses multiple policies. While increasing supply through new construction is necessary to improve affordability, it is equally important to focus on the sustainable reuse of housing stock, as well as on financial resources that support the housing demand of lower-income households.

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Conflict of Interests

The authors declare no conflict of interests.

Data Availability

Links to raw data associated with the analysis presented in the article are listed in the Supplementary File.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

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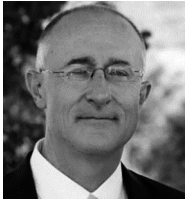
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About the Authors



Francesco Cianfarani is an architect and educator, currently working as an assistant professor of Architecture at the Christopher C. Gibbs College of Architecture, University of Oklahoma. He earned his PhD in Architectural and Urban Design from Sapienza's DiAP Department in Rome. Cianfarani's research lies at the intersection of architecture and urban design, focusing on housing. At the University of Oklahoma, his research and teaching activity explore sustainable urban design practices and infill low-rise housing for the urban core of OKC.



Shawn Schaefer is associate director of Planning, Landscape Architecture, and Design, and a faculty member of the Christopher C. Gibbs College of Architecture. Professor Schaefer holds professional degrees in architecture and urban design. He is licensed to practice architecture and interior design in the State of Oklahoma and is board-certified by the National Council of Architectural Registration Boards, and the American Institute of City Planners as a city planner, and as a Certified Urban Designer. Professor Schaefer is a founding principal of PLACES LLC, Oklahoma's first urban design consulting practice.



Kalyan Mutukundu is a graduate student in the Division of Planning, Landscape Architecture, and Design, pursuing a Master's degree in Regional and City Planning at the Christopher C. Gibbs College of Architecture, University of Oklahoma. He holds a Bachelor's degree in Urban and Regional Planning from JNAFAU, Hyderabad, and has two years of professional experience in India. Kalyan completed an internship with the City of Madras, focusing on municipal code updates, housing action plans, and zoning permits. His research interests include affordable housing, community development, municipal code reform, and transportation planning.