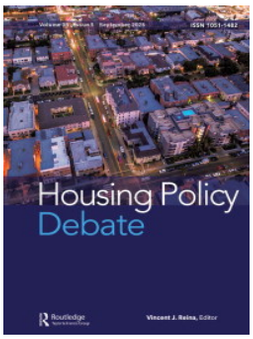

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Changes in Average Household Size and Headship Rates as Indicators of Housing Shortfalls

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ABSTRACT

A recent debate in this journal raised questions of whether the U.S. faces a housing supply shortfall and, if so, how large it may be. Recognizing that household composition is inextricably linked with housing supply, Galster proposed a new indicator of the adequacy of housing supply based on shifts in average household size. We implement this demographic decomposition approach to show that changes in average household size between 2000 and 2019 were smaller than would be expected based on changes in population structure. We also propose and apply an alternative measure using headship rates, which allows us to demonstrate that rates of household formation are also lower than would be expected. Extrapolating from the gap between observed and expected headship rates, we estimate that roughly 8.4 million additional households—and, by extension, occupied housing units—would have been necessary in 2019 to match 2000-level household composition patterns. While we believe that these approaches have merit, we caution that they also have important limits as direct indicators of the adequacy of housing supply.

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Crowding; headship; household size; housing shortage; housing indicators

Introduction

The U.S. is, by most accounts, in the midst of a protracted and worsening housing affordability crisis. Nearly a quarter of homeowners and half of all renter households—42.1 million total households—qualify as housing cost burdened, spending more than 30% of income on rent or mortgage payments (JCHS, 2024). Burdens are especially pronounced for lower-income renters, who often spend the majority of their income on housing: among renters making less than $30,000 annually, 65% spend more than half their income on rent (JCHS, 2024). Since 2000, inflation-adjusted median asking rents have increased by 23.4%, while median renter household income has risen by just 5.3% (CBPP, 2024). In the context of rising costs, doubling up with friends or family members can provide significant financial benefits (Pilkauskas et al., 2014).[1] Sluggish economic growth, high unemployment rates, and reductions in new

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housing construction in the wake of the Great Recession led to reductions in household formation rates and increases in the frequency of doubled-up housing (Lee & Painter, 2013; Myers et al., 2025; Paciorek, 2016).

In response to this situation, advocates and policymakers have proposed liberalizing zoning laws, reforming building codes, and increasing the construction of new housing (Bronin, 2024; Gray, 2022; Schuetz, 2022). Increases in housing supply—even supply of market-rate housing—reduce the pace of rent growth and improve housing affordability (Been et al., 2023). The political push for more housing often references specific estimates of the scale of the housing shortage. For example, the National Low Income Housing Coalition (NLIHC) argues that the U.S. currently faces a shortage of 7.1 million affordable housing units (Harati et al., 2025).

A recent debate in this journal, however, has raised questions of whether there indeed is a shortage of housing at all. McClure and Schwartz (2025), citing census data showing that increases in housing stock outstripped growth in the number of American households between 2000 and 2020, argue that current supply is greater than demand. This analysis was met with skepticism, most notably on the grounds that it overlooks endogenous dynamics: household formation and composition are inextricably linked with housing supply. Household formation may be constrained by housing costs, resulting in more crowded or doubled-up households (Airgood-Obrycki & McCue, 2025; Freemark, 2025; Quercia, 2025).

In response, Galster (2025) proposed a demographic approach to estimating housing supply shortfalls. Specifically, he called for a measure of average household size disaggregated by age, gender, income, race/ethnicity, immigrant status, and various other socio-demographic characteristics. If calculated at time t, these subgroup-specific averages can then be applied to a new population structure at time $t+x$ to measure changes between actual and expected household size and, by extension, between actual and necessary housing supply. As he puts it, the difference between actual and expected average household size "could be easily transformed into one that directly measures how much additions to the housing stock over the period in question have fallen short of "desirable" levels: the number of extra dwellings (and equivalent number of households) that would have been required to keep actual mean household size equal to adjusted mean household size" (Galster, 2025, p. 85). This approach accounts for changes in population structure that are often overlooked in analyses of housing supply (Myers et al., 2025).

Data and Methods

We use 2000 long-form Decennial Census and 2015–2019 American Community Survey (ACS) data accessed through IPUMS (Ruggles et al., 2025) to conduct three sets of analyses.[2] First, we apply Galster's approach—essentially a form of Kitagawa (1955) decomposition—to estimate changes in average household size between 2000 and 2015–2019. Second, we propose and implement an alternative measure, using the same decomposition framework to assess changes in headship rates: the rate at which members of the population form households. Third, we use both approaches to estimate shortfalls in households.

Measuring Changes in Average Household Size

Our first set of analyses measures and evaluates changes in the average size of households in which individuals live, a quantity that we refer to as "average household size." It is important to clarify that there are two commonly accepted ways of measuring average household size: as the average number of people per household and as the average size of households in which people live. We employ the latter.

Consider a hypothetical population of 10 people split into two households, one with two members and the other with eight members. This population has five people per household (10 individuals/2 households = 5 people per household); this is what the U.S. Census Bureau and many analysts would report as the average household size of the population (e.g., Fry, 2019). By contrast, the other approach—which we employ here—provides a person-weighted measure of the household size that the average member of the population experiences, which would be an average household size of 6.8 in this hypothetical situation $\left(\frac{8^2+2^2}{10}=6.8\right)$. Defining household size this way means that we make observations at the individual rather than the household level, which allows us to account for factors that vary among the individuals who constitute a household, such as age, race/ethnicity, and educational attainment. By contrast, the people-per-household measure would not allow for individual attributes and is therefore not well-suited to this decomposition approach.

We cross-classify every individual by age (5-year age bins running 0–4, 5–9, …, up to 85+), gender (male, female),[3] tenure (renter, homeowner), inflation-adjusted household income (classified as negative income; $0 to $29,999; $30,000 to $59,999; $60,000 to $99,999; $100,000 to $149,999; $150,000 to $199,999; and $200,000 or more), race/ethnicity (exclusive categories of Hispanic, Black, Asian American or Pacific Islander, American Indian or Alaska Native, multiracial, White, and other), highest level of education attained (less than high school; high school; less than 4 years of college; 4 or more years of college), and birthplace (U.S.- or foreign-born). Each individual is assigned to a Constant Public Use Microdata Area (cPUMA), the finest level of geography comparable across years in the IPUMS data. Within each subgroup—cross-classified by all socio-demographic characteristics and cPUMA—we calculate (a) the mean number of household members (including the focal individual) and (b) the total number of individuals in the subgroup. We exclude individuals living in institutional settings, such as prisons and nursing homes; this leads us to remove 2.8% of the population in 2000 and 2.5% in the 2015–2019 data (referred to hereafter by the end year of the period). We weight all observations, which represent a single respondent, using IPUMS-supplied person weights.

Using the resulting data, we apply 2000 group-specific means for average household size to the 2019 population counts to assess a counterfactual: if households were formed in the same way that they were 20 years prior, how many people, on average, would Americans have lived with in 2019? Because both observed 2019 average household size and the counterfactual estimates rely on the same population structure, differences between these numbers reflect shifts in how socio-demographic characteristics relate to household size. For example, if foreign-born individuals accounted for a stable share of the population between 2000 and 2019 but their

average household size declined, then the counterfactual would overestimate 2019 household size by using the 2000 average. Conversely, if foreign-born individuals accounted for a rising share of the population but their average household size remained unchanged, then the counterfactual for 2019 would exactly match the actual measurement in 2019, since population shifts along observed dimensions are fully accounted for in our analysis. Therefore, the difference between the 2019 observed and counterfactual household size measurements reflect the aggregate effect of unexplained changes in average household size within all measured socio-demographic subgroups. These changes in subgroup averages may reflect both external constraints (e.g., limited housing availability) and shifting preferences (e.g., changing desired household composition).

Measuring Changes in Headship Rates

An alternative to Galster's approach of measuring average household size is to analyze headship rates: the number of listed household heads divided by the population within the given group. For example, of the population of Black, U.S.-born, female renters aged 20–24 with a college degree making $100,000–$149,999 annually, what share are listed household heads? How have headship rates within this group shifted over time?

This approach depends on the relatively arbitrary distinction of who serves as "person one" for census purposes ("head of household" in census data collected before 1980). Typically, this is just the first person listed on the census form, but could be any household member in whose name the property is owned or rented. Nonetheless, it offers another way of measuring changes in household formation that can be disaggregated using the same set of socio-demographic characteristics.

We use the same data detailed above, counting (a) the total number of household heads in each group cross-classified by all listed socio-demographic characteristics (i.e., age, gender, tenure, household income, educational attainment, race/ethnicity, birthplace, and cPUMA) and (b) the total number of individuals in the subgroup. Using these numbers, we calculate headship rates for both periods and carry out a similar counterfactual exercise: had 2000 group-specific averages been applied to the 2019 population, what headship rates would we have expected? We again exclude the population living in group quarters in both years and apply person weights for all calculations.

Translating to Measures of Household Shortfall

The final step in our analysis involves translating these counterfactual estimates to assess how many more or fewer households would be necessary in 2019 to meet the composition standards of 2000. That is, how many households would we need to add or subtract in 2019 to match 2000-level patterns?

For the measure of average household size, this question is not straightforward to answer because a given population with a set average household size does not imply a single number of households. That is, multiple arrangements of individuals into a varying number of households are possible while maintaining the same average

household size (S) and total population (P). This is because, as discussed above, we measure average household size as the average size of a household that a person lives in rather than the average number of persons per household.

Suppose a population has H households, numbered $i \in \{1,2,\ldots,H\}$; each household contains m_i members (m_i may vary from household to household). The average size of a household that a member of the population lives in is

$$S = \frac{1}{P}\sum_{i=1}^{H} m_i^2 \tag{1}$$

Note that according to this equation, for a given fixed value of P and S, there may be multiple solutions for m_1 through m_H and H. Figure 1 demonstrates this point in a population with 6 people. In Scenario 1, average household size is $\frac{3^2+3^2}{6} = 3$ and there are 2 households. In Scenario 2, average household size is $\frac{1^2+1^2+4^2}{6} = 3$ and there are 3 households. Thus, there are at least two values of H consistent with P = 6 and S = 3.

Nevertheless, it is possible to arrive at a minimum bound on the number of households, H, consistent with a given P and S: a configuration where all households have an equal number of members.[4] Thus, the range of possible number of households (H) consistent with S and P is bounded by a minimum of[5]

$$H_{min} = \frac{P}{S} \tag{2}$$

We use this formula to calculate the minimum number of households necessary to compose the 2019 observed and counterfactual scenarios:

$$H_{min,2019} = \frac{P_{2019}}{S_{2019}} \tag{3}$$

$$H_{min,cf} = \frac{P_{2019}}{S_{cf}} \tag{4}$$

The difference between these two figures represents a minimum estimate on the net surfeit or shortfall in households:

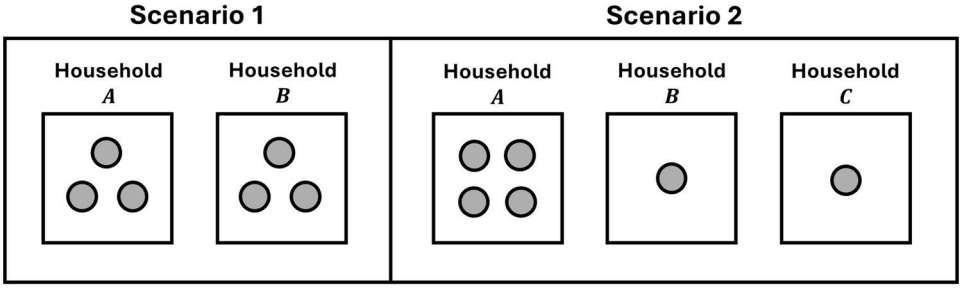

Figure 1. Two population configurations consistent with P = 6 and S = 3.

$$H_{min,2019} - H_{min,cf} = \frac{P_{2019}}{S_{2019}} - \frac{P_{2019}}{S_{cf}} \tag{5}$$

We calculate these figures within each of the cPUMAs.

One significant advantage of using headship rates rather than average household size is that translation to households, and therefore potential household shortfalls, is more direct and results in a single estimate. Headship rates (r) are calculated as the number of household heads (H) divided by the total population (P). Since each household has a single head, the numerator in this rate is the same as the count of households (H). As such, the number of households observed in 2019 is:

$$H_{2019} = r_{2019} P_{2019} \tag{6}$$

And the number of households in 2019 predicted by the counterfactual is:

$$H_{cf} = r_{cf} P_{2019} \tag{7}$$

Therefore, the surplus or deficit of households can be calculated as:

$$H_{2019} - H_{cf} = \left(r_{2019} - r_{cf}\right) P_{2019} \tag{8}$$

We use this formula to calculate the surfeit or shortfall in households necessary to match 2019 observed headship rates to 2000 levels.[6] We again calculate these figures within each of the cPUMAs.

Results

In 2000, Americans lived, on average, in households of 3.467 people; by 2019 that had fallen to 3.374 people, a drop of 2.7%. Average household size is largest at youngest ages and changed relatively little over time for people under age 20. People live, on average, in slightly smaller households throughout their 20s, then see an increase in household size in their 30s. The size of a household that the average American lives in declines monotonically from age 40 onward.

Headship rates fell over the same period as well, from 38.58% to 38.15%.[7] Declines in headship rates were experienced across the life course, though not equally at all ages. In Figure 2, we plot headship rates in 2000 and 2019 by 5-year age groups.

Headship rates were lower in 2019 than they were in 2000 at all ages. This effect, though, is particularly pronounced in early and late adulthood. For example, only 20% of people aged 20–24 were household heads in 2019, down from 28% at the turn of the millennium. For people between the ages of 30 and 74, reductions in headship rates over time were relatively small (3 percentage points or less), but these drops were larger for individuals aged 75 and above (at least 6 percentage points lower).

Average household sizes and headship rates—and the changes in these metrics over time—varied significantly across the U.S. In Figure 3, we plot these measures in both 2000 and 2019 at the state level. The figure makes more clear the approximately

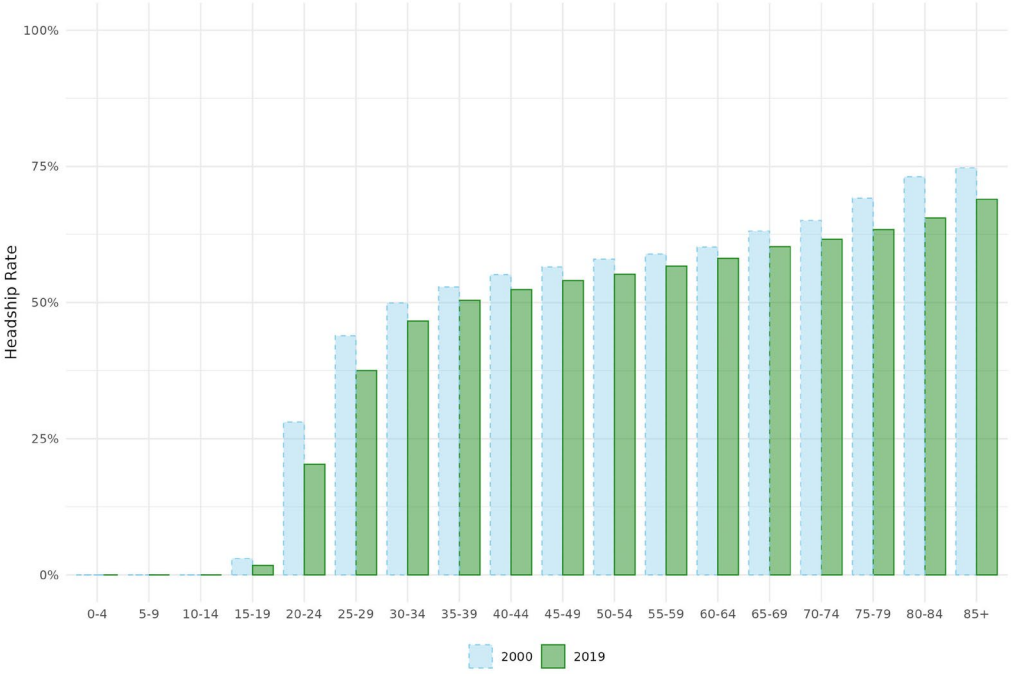

Figure 2. Headship rates by age group, 2000 and 2019.

inverse relationship between these measures: when average household size is lower, headship rates are higher.

Average household size (left panel of Figure 3) in 2000 varied from 3.075 people in Maine to 4.161 people in Utah. Across the 50 states and the District of Columbia (DC), average household size fell between 2000 and 2019 in all but four states (Oklahoma, Alaska, Kentucky, and Tennessee). In 18 states and DC, the drop was larger than the national average (a reduction of 0.093 people per household). Louisiana, DC, New Mexico, California, and Illinois all saw drops in average household size of more than 0.2 people.

In the right panel of Figure 3, we see similar variation in headship rates. In 2000, headship rates ran from a low of 32.00% in Utah to a high of 46.28% in DC. Headship rates fell over time in 25 states and DC, with the largest decline in Florida (40.71% in 2000 to 37.80% in 2019). Rates rose in the other 25 states, with the largest increases recorded in Maine, Michigan, Wisconsin, North Dakota, and Vermont. There is no consistent pattern linking headship rates in 2000 to changes over the subsequent 20 years: rates rose and fell in states with high baseline rates as well as in states with low baseline rates.

If the socio-demographic and geographic correlates of average household size observed in 2000 were applied to the 2019 U.S. population structure, we would expect that average household size in 2019 would have fallen to 3.342 people (see Figure 4). The actual drop in average household size (0.093 people) amounts to 73.9% of the expected decline based on changes in population structure. Likewise, had 2000 patterns been maintained, we would have expected a headship rate of 40.81% in 2019.

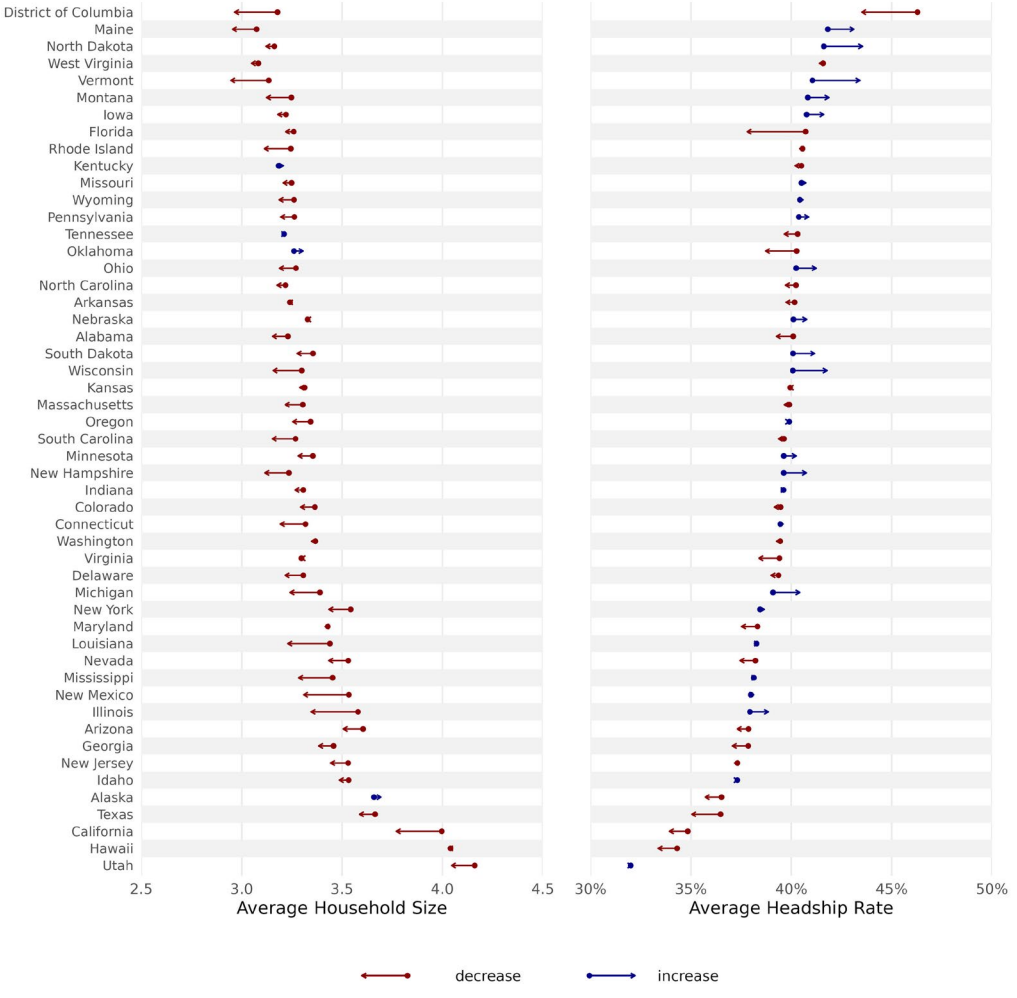

Figure 3. Change in average household size and headship rate by state, 2000–2019.
Note: Arrows point from 2000 level (dot) to 2019 level (arrow head). States are ordered by their 2000 headship rate, from highest (top) to lowest (bottom).

Notably, in this case the observed change (a decrease of 0.43 percentage points) is in the opposite direction as the counterfactual (an expected increase of 2.23 percentage points).

The gaps between 2019 observed and expected average household size and observed and expected headship rates are uneven across the country. In Figure 5 we map these differences at the state level. In the top panel, plotting differences in average household size, states shaded in red have the same pattern as observed in the left panel of Figure 4—higher observed than expected average household size in 2019—while those in purple experienced the opposite (lower observed average household size than would be expected given population structure). We find that average household size declined more than expected in California, Illinois, and across much of the Sunbelt, running from New Mexico to Mississippi. It is important to note that most of the seven states that experienced this pattern had larger-than-average

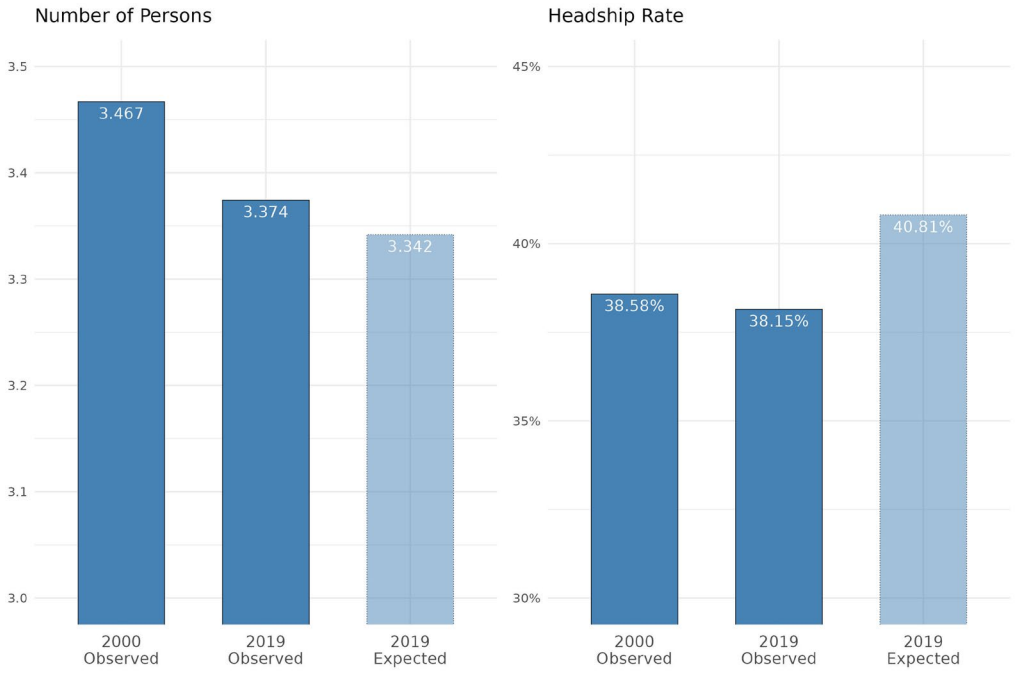

Figure 4. Observed and expected household size and headship rates in 2000 and 2019.

household sizes in 2000. For example, California's average household size was 3.997 people per household in 2000, third-highest in the nation. It experienced the second-largest decline in average household size between 2000 and 2019 (behind only Illinois), though its 2019 average household size was still larger than national average (3.770 vs. a national average of 3.374). Figure 5 illustrates that this decline was larger than we would have expected given changes in population structure. By contrast, average household sizes moved upward relative to expectations throughout the Northeast, most of the Midwest, and Pacific Northwest.

Compared to the mixed findings when analyzing average household size, results using headship rates are consistent: observed headship rates in 2019 fell below expectations in all 50 states and DC (Figure 5, bottom panel). The smallest difference was in Nebraska, where headship increased from 40.11% in 2000 to 40.77% in 2019, still 1.09 percentage points less than the increase to 41.86% predicted under the counterfactual. The five places with the largest gaps between observed values and expectations were DC, Florida, Alabama, New Mexico, and California. With the exception of New Mexico, each of these sites saw a decline in headship rates over time, whereas the counterfactual prediction was of a large increase.

The gaps between observed and expected average household sizes and observed and expected headship rates in 2019 signal that more households—and thus more occupied housing units—would be necessary in order to rebalance the existing population to match household composition patterns in 2000. As evidenced by Figure 5, this overall shortfall is unevenly distributed across the country. Using our measure of average household size, we estimate that 754 of the nation's 1,078 cPUMAs (69.9%)

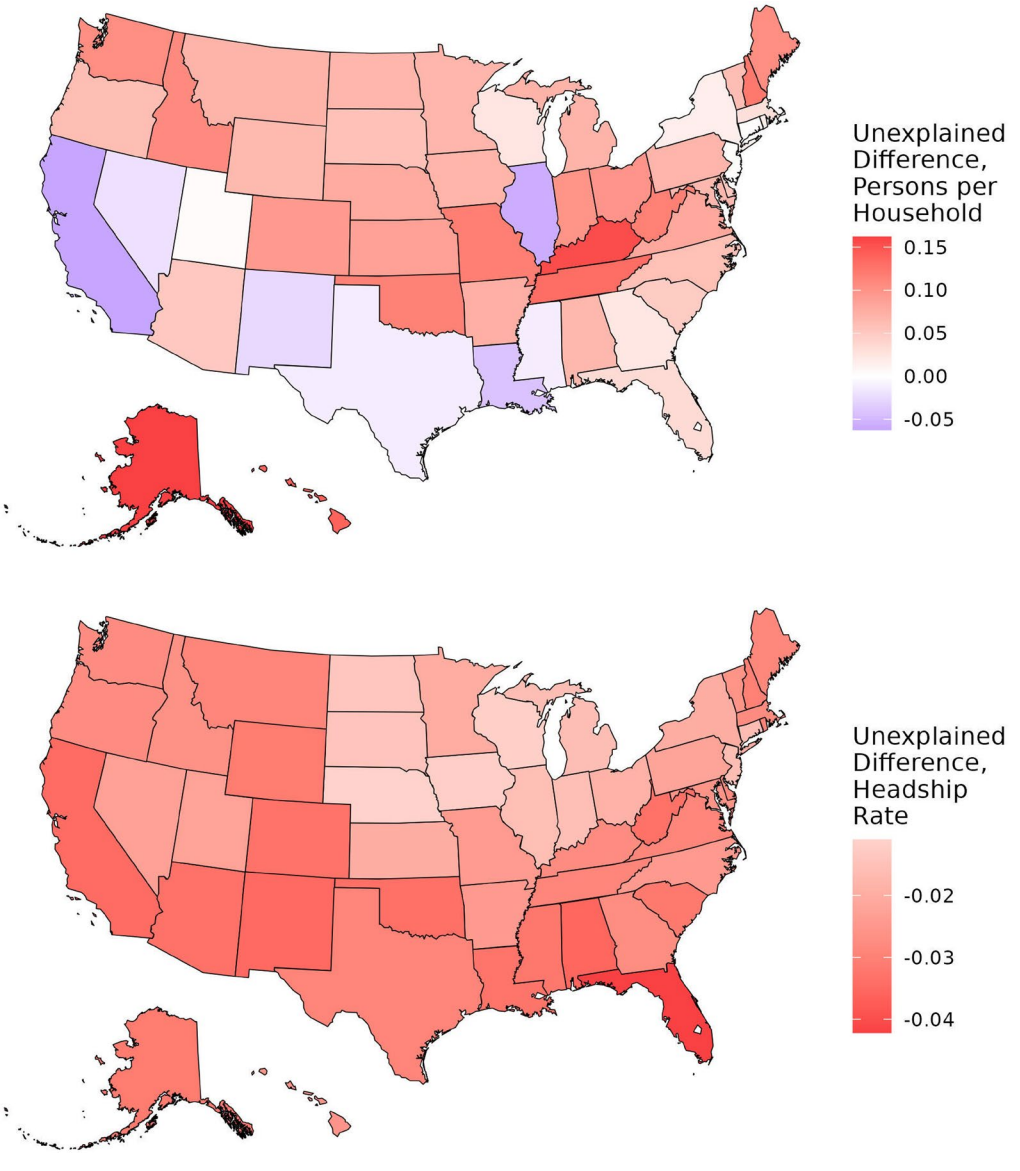

Figure 5. Differences between observed and expected average household size and headship rates in 2019, by state.

Note: The top panel indicates state-level changes in household size that are not explained by socio-demographic correlates, while the bottom panel indicates state-level changes in the headship rate not explained by socio-demographic correlates. In both panels, red coloration indicates a housing shortage according to the counterfactual specification.

would need to increase their number of households in 2019 to reduce average household size to match counterfactual levels. Across these 754 cPUMAs, at least 1.923 million more households would be necessary to match 2000 patterns. By contrast, average household size has fallen below the counterfactual estimate in the other 324 cPUMAs, signaling that fewer households are needed to match 2000 levels.

We conduct a parallel set of calculations with headship rates at the cPUMA level. To match counterfactual levels, headship rates would need to increase in 1054 cPUMAs

(97.8%). Cumulatively, 8.439 million additional households would be necessary to achieve this effect.

Considerably more households would be necessary to allow for further declines in average household size. For example, for the full U.S. population in 2019 to experience patterns on par with what is typical for white Americans, the nation would need between 8.579 million additional households (minimum based on average household size) and 14.016 million additional households (based on headship rates).

Discussion

Average household size decreased between 2000 and 2019, but by less than would have been expected had socio-demographic patterns at the turn of the millennium held two decades later. At the same time, headship rates fell when we would have expected them to increase. Based on calculations of the minimum number of households needed to compose the observed and counterfactual expected 2019 average household sizes, we estimate that at least 1.923 million additional households would have been necessary nationwide in 2019 to match 2000 household composition patterns. To match the headship patterns that were typical of 2000, we would have needed an additional 8.439 million households in 2019.

Our approach of presenting two parallel sets of results using the same decomposition framework—one based on average household size, the other on headship rates—highlights important discrepancies between the metrics. Perhaps most notably, we showed in Figure 5 that California households were smaller than expected in 2019 (implying a household surplus), but that headship rates were well below expectations (implying a household shortfall). Which is right? It is important to keep in mind that the two metrics measure different things: the size of the household in which the average person lives and the rate at which households are formed. The apparently contradictory findings are a function of this distinction. This is to say, both results are "right" in terms of what they measure. As such, we favor an alternate question: which metric is more useful?

One clear drawback of the average household size metric is that we estimate the minimum number of households required to constitute a given population of a certain average household size. This minimum growth is almost an underestimate: it assumes a near-uniform distribution of individuals into equal-size households (see Figure 1 and associated text). Other configurations of such a population are possible while maintaining the same household size. These configurations would result in much larger shortfall estimates. As such, the direct utility of average household size as a measure of household or housing supply shortfalls is, we believe, limited: Our estimate of 1.923 million should be interpreted as an absolute lower bound on the shortfall of occupied households in 2019, rather than a central estimate.

By contrast, headship rates have the advantage of offering a single, clear measure of household surpluses or shortfalls in this decomposition framework. With that being said, we caution that headship rates are imperfect. Household heads are often selected as a matter of survey response convenience and should not necessarily be ascribed any social significance. If there are systematic changes over time in how household heads are selected (e.g., if women are marked as household heads more often than

they used to be, conditional on household composition), this could bias results in uncertain directions. Still, we regard 8.439 million as a reasonable estimate of the shortfall in the number of households added to the population between 2000 and 2019.

Regardless of metric, the deficits in *households* that we document could reflect a number of factors. As Galster (2025) suggested, rising unaffordability and restricted housing supply are one explanation. It is, after all, hard to form new households when no affordable housing is available. Yet a comparison of both panels of Figure 5 with previous state-level estimates of housing supply shortfalls suggests imperfect spatial agreement. We demonstrate household deficits—using both average household size and headship metrics—in several states with well-recognized deficiency in housing supply (e.g., Colorado, Washington, Florida), yet there are also striking contradictory cases. For example, NLIHC lists Nevada as the state with the fewest affordable and available rental homes (only 17 such homes per 100 extremely low-income renter households; Harati et al., 2025). We find, despite this scarcity of affordable housing, that average household size fell by more than would be expected between 2000 and 2019 and that observed headship rates are relatively close to counterfactual expectations (Nevada ranks 35th in the nation for absolute size of the gap between observed and counterfactual headship). Alabama, by contrast, has a much larger supply of affordable units (52 per 100 extremely low-income households, sixth best in the nation), but we identify it by both metrics as facing a relatively severe household shortfall.[8]

This highlights an important limitation of this demographic approach as an indicator of housing supply. Other explanations for the overall shortage in households are equally plausible, including changing labor market dynamics, shifting expectations around cohabitation, and changing cultural norms about living with parents and children. For example, even if access to housing remains constant over time and even when controlling for total income, individuals may be less likely to form new households if their employment has grown more unstable or irregular, as much work did over this period (Hacker, 2006; Kalleberg, 2011).

Two other notes of caution are worth emphasizing. First, our counterfactual estimates depend on holding constant housing composition patterns from the year 2000. This is an arbitrary choice and there is no reason to consider average household size or headship rates from the turn of the millennium as necessarily "ideal." We caution against reifying these rates. Second, our estimates in no way address issues of housing affordability, quality, or currently available housing stock that are central to many analyses of these topics (McClure & Schwartz, 2025).

Ultimately, both housing supply and other factors contribute to the patterns documented here, but our results do not allow us to distinguish between the relative significance of each or their varying importance in different parts of the country. We encourage further research assessing whether the current housing stock—considering its quality, location, cost, and overall availability—adequately meets population needs and is correlated with the measures of household shortfalls presented here. This work would be most productive at the metro level, whereas we operate at the cPUMA and state levels due to limitations in publicly available data. While we leave unexplored

the question of which factors drive most observed changes in average household size and headship rates, we encourage future researchers to detail the contributions of the various socio-demographic characteristics that we include in our analyses. We also hope that this work motivates analysis of other, non-housing factors that might explain changes in household formation. We caution that disentangling these explanations will be no small feat: there is considerable endogeneity between household formation, housing supply, and other social dynamics. Indeed, we note that even population structure—which we treat as given here in 2000 and 2019—is responsive to these factors. For example, restrictions in housing supply or increasing cost of housing may lead to lower odds of parity progression. Still, we believe this work is critical in better understanding how much housing supply the U.S. needs and where.

Notes

1. These arrangements may also entail meaningful non-financial costs. A number of researchers have explored the long-term consequences of doubled-up and multigenerational housing for child, maternal, and family well-being (Dunifon et al., 2014; Harvey, 2020, 2022; Harvey et al., 2020).
2. Detailed instructions and code to replicate all analyses are available at https://github.com/lorae/american-housing-shortfalls. We use 5-year rather than 1-year ACS estimates because the former allow for greater precision when analyzing characteristics of small populations. We replicated all analyses with 1-year estimates for 2019, yielding substantively similar results, which are available upon request.
3. The Census Bureau's "SEX" variable only allows for male, female, and missing values.
4. A maximum bound is reached when the population is structured in a large number of one-person households paired with one household of extraordinary size. Because such a structure is unrealistic and the quantity uninformative, we do not report it.
5. Even if P/S is not an integer (and thus not physically attainable, since households are measured as countable units), this formula still defines a value lower than the minimum possible H.
6. Myers et al. (2025) conduct a similar counterfactual exercise using homeownership and rentership rates between multiple pairs of years, standardizing for age and race/ethnicity, to estimate shortfalls in owner and renter households.
7. Note that we calculate headship rates across the full population. As Figure 2 makes clear, children under age 15 are never recorded as household heads. The headship rate for the population aged 15 and older in 2000 was 49.4% and had fallen to 47.2% in 2019. It is not possible for headship rates and average household size (as measured at the household level) to move simultaneously in the same direction because they are direct inverses of each other. Average household size at the individual level, however, is not monotonically related to headship and it is possible for both measures to fall simultaneously (see Figure 1 and associated text). This can occur, for example, when the population grows while the variance in household size decreases.
8. Using the methods for measuring housing shortages detailed by McClure and Schwartz (2025), every state is listed as having a housing surplus as of 2020. There is little agreement between the states with the smallest or largest surpluses and those that we identify as having more or less severe housing shortfalls.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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