Worker Age, Jobs-Housing Balance, and Commute Distance

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Abstract

Anecdotal evidence suggests that the affordable housing crisis is forcing households to seek lower cost housing in the outer reaches of major metropolitan areas, helping to explain recent increases in commute distance. In this study we examine the location of young workers (under 30) and their jobs. We then test whether the relative availability of housing is associated with the commute distance of young workers, many of whom are relatively new to the labor market. To test this relationship, we use spatial regression to examine the relationship between the availability of housing in close proximity to jobs (jobs-housing balance) and commute distance in two high-cost metropolitan areas in California: Los Angeles and the San Francisco Bay Area.

Controlling for other characteristics, commute distance is longer in neighborhoods with more jobs relative to housing. The effect size is stronger in San Francisco—where housing is most constrained—compared to Los Angeles. However, contrary to our hypothesis, jobs-housing balance is important to all workers regardless of age. Finally, while housing availability is associated with commute distance, its contribution is small relative to other factors. The findings suggest the importance of policies to greatly enhance housing availability in high-cost metropolitan areas. They also underscore the need to go beyond housing policy in efforts to significantly increase access to employment and reduce travel.

Keywords: commute distance, young workers, jobs-housing balance, residential location

INTRODUCTION

Data for California show that commutes are growing. From 2001 to 2019, mean commute time in the state increased by more than 16 percent, among commuters across major modes (Ruggles et al., 2021). One explanation for this increase is the lack of affordable housing that forces some households to seek lower cost housing in the outer reaches of major metropolitan areas. A 2017 article in the *New York Times* profiled the story of Sheila James who moved from the city of Alameda (15 miles east of San Francisco) to Stockton (80 miles northeast of San Francisco) where housing is cheaper (Dougherty & Burton, 2017). Her change in residential location required a 3-hour, one-way commute, two trains and a bus. Long distance commutes can be detrimental to individuals as well as to the environment—adversely affecting economic mobility, activity participation, health, and air quality.

Some studies, however, suggest that younger workers have a greater preference for urban living compared to older workers (Ehlenz et al., 2020; Y. Lee, Lee, et al., 2019; Pfeiffer et al., 2019; Raymond et al., 2022). They tend to be more likely over time to live in downtown neighborhoods in close proximity to employment and other amenities (Baum-Snow & Hartley, 2020; Cortright, 2020; Couture & Handbury, 2020; Moos, 2014; Raymond et al., 2022). However, many young adults may not be able to act on their residential location preferences due to a lack of affordable housing, potentially limiting the choice of downtown living to higher-wage, white, and more highly-educated households.

In this study, we first examine recent changes in commute distance, job location, and residential location of workers by age group in two high-cost California metropolitan areas: Los

Angeles and the San Francisco Bay Area.[1] Our analysis centers on young workers, workers under 30, relative to older workers, those 30-54. We then test the relationship between the availability of affordable housing and commute distance for both age groups. The analysis draws on data from the 2015 Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) supplemented with neighborhood-level data from the 2013-2017 5-year American Community Survey (ACS).

We find that competition for housing is associated with commute distance in both metropolitan areas. Controlling for other determinants, commute distance is longer in neighborhoods where there are more jobs relative to housing. As we might expect, the contribution of this factor to explaining commute distance is stronger in the San Francisco Bay Area—where housing is most constrained and expensive—compared to Los Angeles. However, contrary to our hypothesis, jobs-housing balance is important to all workers regardless of age. Finally, while housing availability is associated with commute distance, its contribution is small relative to other factors. The findings suggest the importance of policies to greatly enhance housing availability particularly in high-cost metropolitan areas such as Los Angeles and the San Francisco Bay Area. They also underscore the need to go beyond housing policy in efforts to significantly increase access to employment and, therefore, potentially reduce vehicle miles of travel.

YOUNG WORKERS AND THE COMMUTE

Traditional explanations for commute distance extend from the monocentric city model

[1] The Los Angeles MSA includes Los Angeles and Orange counties. The San Francisco Bay Area MSA includes Alameda, Contra Costa, Marin, San Francisco, and San Mateo counties.

and bid-rent theory (Alonso, 1964; Mills, 1967; Muth, 1969), the notion that higher-income households will tend to live in outlying neighborhoods, distant from downtown, where land prices are relatively cheap, allowing families to purchase large homes on substantial lots. In contrast, lower-income households will settle in urban neighborhoods close to downtown when the income elasticity of demand for land is larger than the income elasticity of travel costs. Consequently, higher-wage workers will travel longer distances from the suburbs to city-center employment, while lower-wage workers will commute relatively short distances to central-city jobs.

Scholars have challenged the merits of the monocentric city model given the ongoing decentralization of employment (Angel & Blei, 2016) as well as argued that the theory greatly oversimplifies residential location decisions relative to a single factor–firm location (O'Sullivan, 2012). Despite these critiques, the basic relationship between income and commute distance remains. Data from the 2017 National Household Survey shows a generally positive relationship between income and commute distance particularly for workers with household incomes up to $150,000 (Federal Highway Administration, 2018).

On average, young workers in the U.S. have lower total earnings than older workers. For example, data from the 2017 American Community show that the mean earnings of U.S. workers under 30 was less than half that of workers 30-54, $22,134 compared to $56,202 (Ruggles et al., 2021). Moreover, compared to older workers, on average younger workers earn lower hourly wages and work fewer hours.

Human capital theory posits that investments in human resources such as education, job training, and work experience improve worker efficiency and productivity and, therefore, earnings (Becker, 1962; Mincer, 1975). Younger adults typically accumulate human capital by attending school, motivated by the length of time that they have to benefit from their educational degrees (Mincer, 1975). While most investments occur at younger ages, workers can accumulate human capital—education, job training, work experience—throughout their work lives, but tend to do so at a diminishing rate as they age (Mincer, 1975). As Balcar (2012) summarizes, supply-side determinants of wages typically include variables that measure years of school attendance or levels of educational attainment as well as labor market experience and firm-specific tenure. Because of the strong association between age and human capital investments, researchers often use age as a proxy for labor market experience.

Putting both these theories together, we would expect younger workers with less human capital to have lower earnings and, therefore, commute shorter distances than prime-age working adults. Further, a number of studies suggest that the shorter commute distances of younger adults can be explained by their growing *preference* for living in walkable and amenity-rich urban centers. Studies show an increase over time in the number of young adults residing in downtown neighborhoods (Cortright, 2020; H. Lee, 2020; Y. Lee, Lee, et al., 2019; Moos, 2014). One strategy that young adults use to manage the high cost of centrally-located housing is living in compact and shared units (Heath et al., 2017).

Two factors potentially offset these trends. First, a growing percentage of young adults live with their parents and other family members. The percentage of young adults (18 to 29) living with a parent increased from 31 percent in 1970 to 47 percent in February 2020 (Fry et al., 2020). The percentage increased during the COVID-19 pandemic. About one-in-ten young adults (18-29) moved due to COVID, with more than 60 percent of movers relocating to live with family members (Cohn, 2020). As of July 2020, more than half (52%) of all young adults lived with a parent (Fry et al., 2020). Life cycle effects combined with the tendency to age in place mean that many of these young adults are living with their parents in households located outside of the city center.

Second, housing costs have increased in the urban cores of large metropolitan areas (Murray & Schuetz, 2018), potentially making it difficult for some young adults to act on their preference for urban living (Y. Lee, Circella, et al., 2019; Moos, 2014). Median housing prices increased significantly in both of our study regions. For example, from 2002 to 2015 home prices in the Los Angeles MSA increased from $256K to $456K (in 2015 dollars) and from $439K to $674K in the San Francisco Bay Area (U.S. Census Bureau, 2000, 2017). The high cost of housing may help to explain why the trend toward urban living among young adults has been particularly prevalent among those who are white and well-educated and have higher-incomes (Baum-Snow & Hartley, 2020; Couture & Handbury, 2020).

Many factors other than proximity to destinations (e.g. neighborhood amenities such as high-quality schools, larger houses and lot sizes) influence residential location choice (Giuliano, 1991). However, some scholars find that the balance between jobs and housing—particularly a better match between worker wages and affordable housing—is associated with shorter commute distances (Blumenberg & Siddiq, 2022; Blumenberg & Wander, 2022; Cervero, 1996; Peng, 1997; Sultana, 2002). This relationship suggests that, while job-housing balance alone may not be the answer to growing vehicle miles of travel, it may expand the range of locational choices available to households with limited resources (Levine, 1998).

METHODOLOGY

In this study, we examine age, availability of housing, and commute distance by workplace location. We hypothesize that the availability of housing—among other characteristics—is associated with shorter commute distances, particularly for young workers who, on average, have more limited labor market experience and, therefore, lower incomes than higher-income workers. We test this relationship using data for two high-cost California metropolitan areas: Los Angeles and the San Francisco Bay Area.

We use data from the 2002 and the 2015 Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES), state administrative data assembled by the Center for Economic Studies at the U.S. Census Bureau (U.S. Census Bureau, 2002, 2015). The data include information on the job location of workers, the residential location of workers, and the location of workers relative to their jobs. We focus on the workplace, since studies suggest that workplace characteristics are more strongly associated with commute behavior than residential location characteristics (Chacon-Hurtado et al., 2019; L. Hu & Schneider, 2017).

The data are available at the census block level. We use this small geography to calculate network commute distance. Network distance provides more accurate estimates of travel than straight-line distance, particularly in metropolitan areas, like Los Angeles and the San Francisco Bay Area, where topography (the presence of both mountains and bodies of water) can influences travel routes. We identified the shortest road network path as of 2018 using the Open Source Routing Machine (OSRM), an open-source router, and the latitude and longitude coordinates for each block origin and destination pair. We then aggregated these data to the census tract and supplemented the 2015 data with additional data from the 2013-2017 5-year American Community Survey. The LODES data report origins and destinations for workers in three age categories: under 30, 30-54, and 55 and older. We limit our analysis to a comparison between workers in the two bottom age groups, younger workers and prime-working-age workers (30-54).

We start with basic descriptive data on commute distance by age, year, and metropolitan area. We then present data on the spatial distribution of workers and their jobs applying two common indices: the index of dissimilarity and the index of relative centralization. The index of dissimilarity measures the spatial distribution of a population group across census tracts within a metropolitan area. The measure indicates the percentage of the group that would have to change location for each neighborhood to have the same percentage of the population group as the metropolitan area. The formula takes the following form:

$$\frac{\sum_{i=1}^{n}(t_i\,|p_i - P)}{2TP(1-P)}$$

Centralization is the degree to which population groups—in this case, younger and older adults—live or work near the central city. We present an index for relative centralization, "the relative share of the minority population that would have to change their area of residence to match the centralization of the majority" (U.S. Census Bureau, 2021). Negative index values indicate that members of the minority group are located farther from the city center than the majority group; positive values indicate the opposite. The formula takes the following form:

$$\frac{\left(\frac{\sum_{i=1}^{n}\frac{x_i a_i}{X}}{\sum_{i=1}^{n}\frac{y_i a_i}{Y}}\right)-1}{\left(\frac{\sum_{i=1}^{n1}\frac{t_i a_i}{T_2}}{\sum_{n2}^{n}\frac{t_i a_i}{T_2}}\right)-1}$$

We then model median commute distance by workplace census tract and age group by year. The model results are similar for both years; therefore, we report the results based on the 2015 data.[2] Median commute distance variable is negatively skewed and, therefore, requires a logarithmic transformation to approximate a normal distribution. The models predict commute distance as a function of three types of characteristics—housing, employment, and location. The models take the following form:

ln (Commute distance from workplace census tract) = $f(H, E, L)$ (Equation 1)

where H denotes a vector of housing characteristics (median home value, jobs-housing ratio), E denotes a vector of employment characteristics (the number of low- and medium-wage jobs relative to high-wage jobs, the number of young workers relative to older workers), and L denotes a vector of locational characteristics (distance from downtown, location in an employment center, and county fixed effects).

To identify whether census tracts are located in an employment cluster/center, we use the method developed by Giuliano and Small (1991) and Giuliano et al. (2007). A tract is located in an employment cluster/center if it is (a) in a set of contiguous tracts (b) with a minimum 10 employees per acre and (c) together the tracts have a minimum total employment of 10,000. Commute distance into major job centers tends to be longer than commute distance into secondary job centers (Cervero & Wu, 1998; Giuliano, 1991).

Finally, to test the association between housing and commute distance, our models include median home value and the ratio of jobs to resident workers as our proxy for the relative availability of housing. For the latter variable, we apply a linear distance-decay function as follows.

[2] The results of the 2002 models are available from the authors.

Jobs-housing ratio for census tract$_i$ =

$$\frac{\sum_j \text{All jobs}_j + \sum_k \text{All jobs}_k\ (-0.4\text{d} + 1.2)}{\sum_j \text{Employed residents}_j + \sum_k \text{Employed Residents}_k\ (-0.4\text{d} + 1.2)}$$

(Equation 2)

where *j* indicates the block groups that have centroids within 0.5 miles of the population weighted centroid of census tract *i*, *k* indicates the block groups that have centroids between 0.5 and 3.0 miles of the population weighted centroid of census tract *i*, and *d* is the straight-line distance between population-weighted centroids of census tract *i* and block-group *k*.

Table 1 includes descriptive statistics for the dependent and independent variables in the regression models. The bolded rows indicate variables that are statistically different between the two metropolitan areas. The data show that commute distances are slightly longer in the San Francisco Bay Area than in Los Angeles, although the difference in commute distance between the two metropolitan areas is only statistically significant among younger workers. Moreover, counter to our hypothesis, younger workers commute slightly further than older worker in both of the regions; the difference in commute distance by age is significant in both metropolitan areas. In both regions, the ratio of jobs to housing—our variable of interest—was similar, about 0.8 jobs per each resident worker. The two regions also perform similarly on our measure of centrality; the median tract falls approximately 17 miles from city hall.

However, there are significant differences between the two regions. While housing prices in both metropolitan areas were high, they were about 32 percent higher in the San Francisco Bay Area than in Los Angeles. Workers in the San Francisco Bay Area also were more likely than workers in Los Angeles to work in an employment cluster and, likely related, in jobs located close to rail stations. The rail access measure is more than twice as large in the San

Francisco Bay Area region compared to Los Angeles. This finding likely reflects the influence of the well-developed BART and Muni rail networks in the San Francisco Bay Area; Los Angeles' Metro Rail service was significantly less well developed. The data also show that relative to Los Angeles, the San Francisco Bay Area had a higher percentage of well-paying jobs and a slightly lower percentage of young workers (<30).

Finally, the county variables indicate the relative percentage of tracts captured in each county in either region. In terms of the number of tracts, the Los Angeles MSA is more heavily dominated by a single county—Los Angeles County—than the San Francisco Bay Area. In contrast, the San Francisco Bay Area MSA consists of five counties. Only 20 percent of the Bay Area tracts are located in San Francisco County, the county with the largest employment center; the remainder of the tracts are dispersed throughout the San Francisco Bay Area with the largest percentage in Alameda County, the county located across the bay and immediately east of San Francisco County.

Table 1 Descriptive Statistics for Model Variables (Workplace Census Tracts) (2015)

Independent Variables	**Los Angeles**	**San Francisco Bay Area**
Median Commute Distance		
< 30	**11.9**	**12.6**
30-55	11.4	12.1
Housing Characteristics		
Median home value (2015$)	**$456,277**	**$674,218**
Jobs-Housing Ratio	0.831	0.816
Employment Characteristics		
Ratio: # of lower- and medium-wage jobs relative to higher-wage jobs	**2.5**	**1.6**
Ratio: # young workers to older workers	**0.39**	**0.35**
Locational Characteristics		
Distance from city hall (miles)	**15.4**	**14.3**

Employment cluster (Mean)*	**0.11**	**0.14**
Proximity to rail (Mean)*	**0.19**	**0.45**
County (Mean)*		
Orange	0.2	
Alameda		0.37
Contra Costa		0.21
Marin		0.06
San Mateo		0.16

*The median values for these variables is 0; therefore, for descriptive purposes we report the mean values.
Note: Bolded rows signify statistically-significant differences between the two metropolitan areas.

We estimate four ordinary least squares (OLS) regressions to predict commute distance by age group for both metropolitan areas. For all of the models, the Moran's I test for regression residuals suggests the presence of spatial autocorrelation and the use of spatial regression to address this issue. To measure the influence of spatial autocorrelation on our model results, for each of our models we constructed a spatial autoregressive model. Spatial autoregressive models allow us to calculate measures of dependence between spatially-dependent observations (i.e., observations whose value exhibits some level of spatial dependence). In our models, we define neighborhoods in terms of Queen's contiguity, so that spatial units that share any common border of non-zero length are considered neighbors. Queen's contiguity is a less stringent definition of contiguity than other commonly-used definitions such as rook contiguity. Consequently, our model outputs assume a higher level of contiguity, and thus a higher level of influence of spatial units on neighboring spatial units, than would be present under more restrictive definitions of contiguity. We ran spatial autoregressive versions for all four of the models whose results we present in Table 2. For each spatial autoregressive model, either the rho parameter was not significant—indicating that the null hypothesis that the OLS model is a better fit should fail to be rejected— or the rho parameter was significant, but the spatial autoregressive model did not change the direction or magnitude of the coefficient effect sizes. In other words, for none of the eight models did running the spatial autoregressive version of the model substantively change the interpretation of the results. The spatial autoregressive versions of our models thus function as a robustness check on our results, demonstrating that our results hold even after controlling for spatial dependence in our variables.

There are a few limitations to the LODES data. First, the data do not account for workers who hold more than one job at the same time, which may potentially bias measures of jobs-housing balance (Horner & Schleith, 2012). This issue may be particularly problematic for younger workers who are more likely than older workers to hold "non-standard" positions (Kalleberg, 2018). Even so, the percentage of multiple job holders is relatively low, approximately 7.5 percent of all workers (Bailey & Spletzer, 2021).

Second, the LODES data do not include all workers. The Census Bureau assembles these data from administrative records from the state unemployment insurance (UI) program. Some employers are exempt from UI participation (State of California. Employment Development Department, nd); others operate in the informal sector possibly to avoid paying UI and other taxes (Nightingale & Wandner, 2011). It is difficult to predict the number of workers excluded from the UI data, a number that likely varies across industries.

Third, employers may report locations that in some cases are the administrative headquarters of the firm and in other cases the physical site to which the employee reports. To minimize this issue with the data, employers with multiple locations are required to submit a Multiple Worksite Report. Because of this requirement, non-compliance in data reporting among multi-unit employers is low (less than six percent) (Graham et al., 2014).

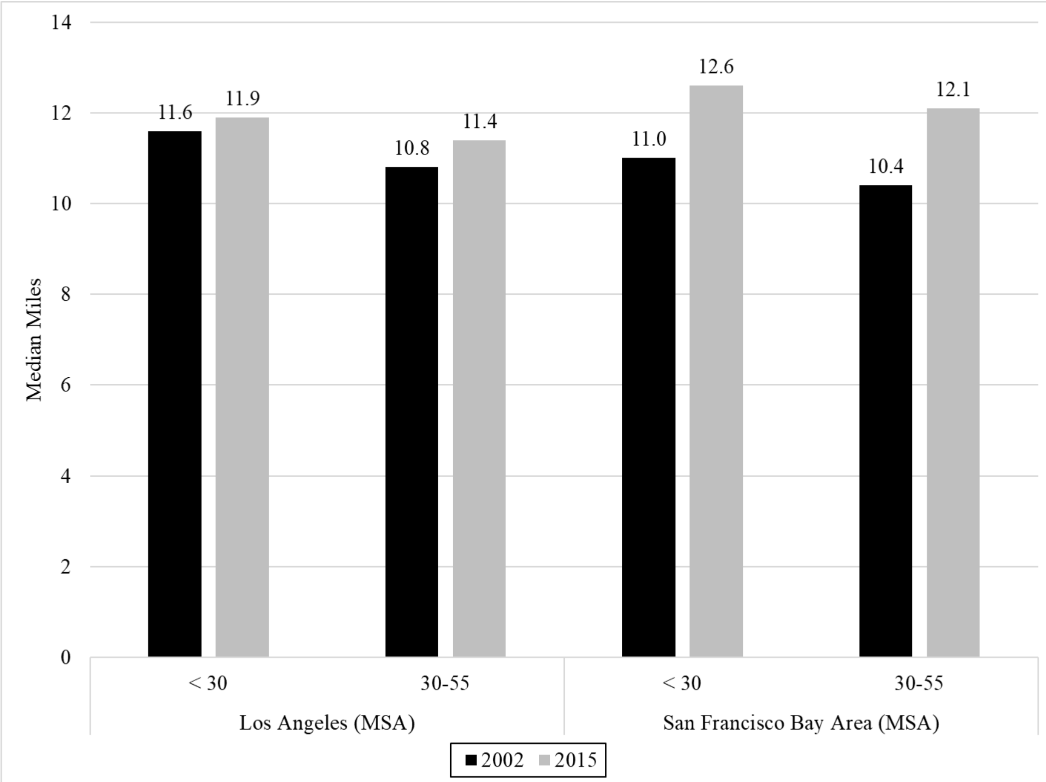
Fourth, LODES data do not include information on how frequently (if at all) workers actually travel to work; the data also do not include information on travel mode. The first of these issues is a topic that has received significant attention during the COVID-19 pandemic. As of 2013-2017 5.4 percent of workers in Los Angeles and 6.3 percent in the San Francisco Bay Area worked from home. This amounted to 5.6 percent of workers in the two regions combined (Ruggles et al., 2021). Perhaps due to less flexible work arrangements and lower seniority, younger workers were less likely to work from home than older workers (2.9 percent vs 5.7 percent). The percentage of workers who work at least part-time from home remains low but has increased. Teleworking is likely to grow faster among higher-skilled and better-compensated workers. This is likely to compound disparities in commute burdens across workers of different wage levels, as higher-wage workers are better able to reduce the financial burden of commuting than lower-wage workers (Dey et al., 2020).

Finally, changes made to the way that the LODES data are reported and measured introduce some uncertainty. The process by which the state of California collects unemployment data is not necessarily consistent over time, and the empirical effect of this on bias in the data is unmeasurable. We assume that the 2015 LODES data is more complete than the 2002 data in line with the increased availability of administrative data in general over this time period. Additionally, LODES wage data are reported categorically in an effort to protect worker privacy. The parameters for these categories do not adjust for inflation. Over time, then, there are proportionately fewer low- and mid-wage workers and proportionately more high-wage workers simply as a function of rising nominal wages, in addition to changing numbers of workers overall. This makes changes over time in relation to worker wages conceptually difficult to interpret, yet another reason for regression models using the 2015 data.

COMMUTE DISTANCE, JOB LOCATION, AND WORKER LOCATION

Figure 1 shows the median of tract-level median commute distances across census tracts and by age group over time. In both metropolitan areas, younger workers commute slightly farther than older workers. From 2002 to 2015, median commute distances increased for workers in both age groups and in both regions. Median commute distances for workers under age 30 in Los Angeles and Orange MSA increased by 0.3 miles (a 2.7% increase) from 2002 to 2015. Commute distances for workers ages 30-55 in Los Angeles increased by twice that amount, or 0.6 miles (a 5.7% increase). The increase in commute distance over time was far greater in the San Francisco Bay Area compared to Los Angeles. However, the increase was quite similar between the two worker age groups. Commute distances for the youngest workers increased by 1.6 miles (a 14.6% increase) from 2002 to 2015, while commute distances for workers ages 30-55 increased by 1.7 miles (a 16.6% increase). In short, commute distances for workers in both age groups increased more rapidly in the San Francisco Bay Area than in Los Angeles, such that by 2015 workers in both age groups in the San Francisco Bay Area were commuting further.

Figure 1. Median Commute Distance by Worker Age Group and Year



As we note previously, studies show that the residential location of younger adults tends to be more centralized (e.g. live close to central business districts) over time (Baum-Snow & Hartley, 2020; Cortright, 2020; Couture & Handbury, 2020; Moos, 2014; Raymond et al., 2022). However, there is little information on the spatial distribution of the jobs that young adults hold relative to those of older adults. To better examine the geographic location of workers and their jobs by age, in Table 2 we report indices of dissimilarity and relative centralization over time. The dissimilarity indices for worker residential location remained fairly stable in Los Angeles and increased modestly in the San Francisco Bay Area from 2002 to 2015 such that workers in the San Francisco Bay Area were slightly more segregated in 2015 than workers in Los Angeles. In both metropolitan areas, the work locations of young adults were more segregated than the residential locations.

Dissimilarity values for worksites increased modestly in Los Angeles. In the San Francisco Bay Area, however, dissimilarity values for worksites decreased modestly, perhaps reflecting the maturing of the area's technology industries as firms moved from riskier start-ups to established going concerns more attractive to older workers. Even so, dissimilarity values changed by less than a percentage point in all cases. Relative centralization values for worker residence in both metropolitan areas was close to zero and changed very little over time, indicating that the minority group (in this case, younger workers) are about as centralized as members of the majority group, older workers. With one exception (2015 in the San Francisco Bay Area), the jobs of younger workers are slightly more centralized than the jobs of older workers but still in all cases close to 0. These results indicate relatively little worker and employment segregation by age and more continuity than significant change over this time period.

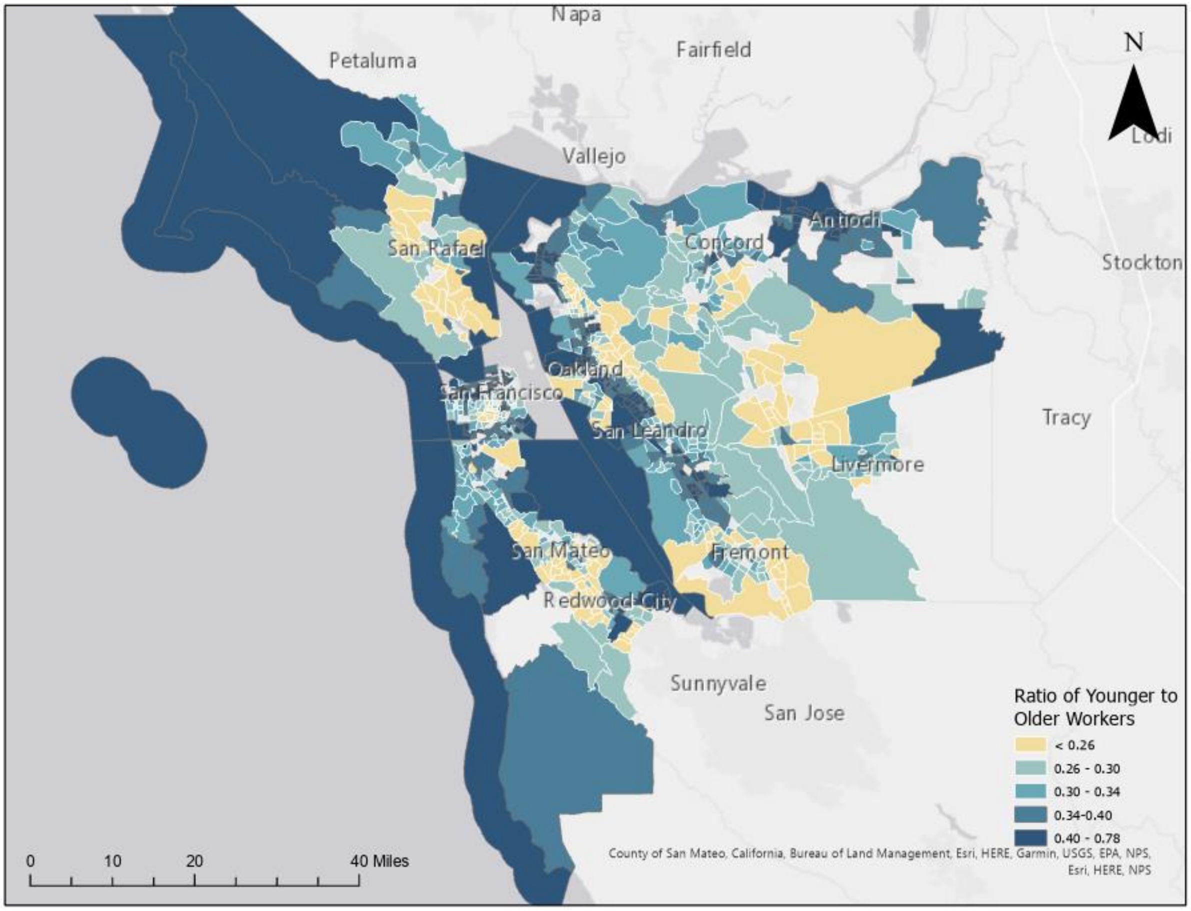
Table 2. Spatial Distribution of Worker Residences and Workplaces – 2002 and 2015

	Los Angeles		**San Francisco Bay Area**	
Index of Dissimilarity	2002	2015	2002	2015
Worker residence	8.6	8.7	8.4	9.2
Worker workplace	13.2	14.4	13.4	12.5
Relative Centralization				
Worker residence	-0.005	-0.009	-0.006	0.010
Worker workplace	0.0213	0.0269	-0.018	0.0008

Figures 2 and 3 visualize the spatial distribution of worksites by worker age in the two study areas in 2015. We map the ratio of younger to older workers by quintiles. Older workers constitute a larger percentage of the workforce than younger workers in most tracts. However, we find clusters of tracts that have a disproportionately older workforce near many of the region's largest cities, including San Francisco, San Rafael, Oakland, San Mateo, Fremont, and

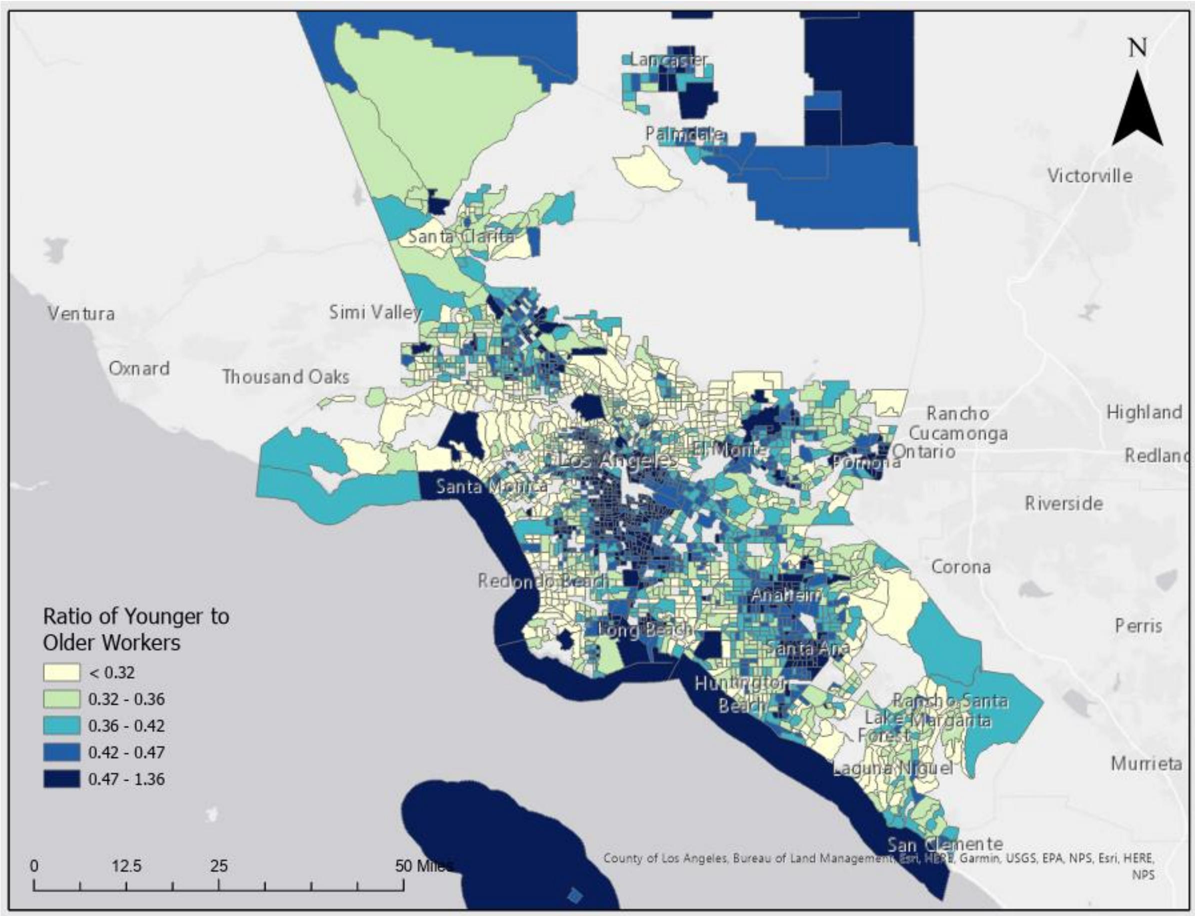
Redwood City. This pattern suggests that higher housing costs (i.e., more competition for housing) in the most expensive areas of the Bay Area may incentivize younger workers to seek employment in more peripheral locations with less expensive housing.

Figure 2: Age Ratio of Workers by Workplace Location, San Francisco Bay Area (2015)



In Los Angeles, younger workers comprised a relatively large percentage of workers in the densest areas of downtown Los Angeles that also tend to feature less expensive, older, and multi-family housing. Younger workers also constitute a large percentage of the workforce in Anaheim and other locations in Orange County dominated by tourism-focused employers in the service sector such as Disney Land. Younger workers also dominate in the most northern regions of the MSA with some of the least expensive housing such as Lancaster and Palmdale as well as in the area around the Port of Long Beach. Older workers, by contrast, dominate the wealthy western, coastal, and suburban areas such as Santa Monica and Laguna Niguel with some of the region's highest housing costs. As in the San Francisco Bay Area, in Los Angeles these patterns suggest significant clustering of workers by workplace based in part on age and local housing costs.

Figure 3: Age Ratio of Workers by Workplace Location, Los Angeles (2015)



HOUSING AND THE COMMUTE

Table 3 presents the results of the OLS models. For the most part, all of the variables perform similarly in terms of the direction of effect across all four models. The ratio of jobs to resident workers, our variable of interest, is statistically significant and positive across all four models. The positive sign of the coefficient for this variable indicates that workers who work in areas with higher ratios of jobs to resident workers—in other words where there is less available housing—tend to commute longer distances. This variable has a stronger association with commute distance in the San Francisco Bay Area than in Los Angeles. However, contrary to our hypothesis, the effect appears to be stronger for older workers in both regions than younger workers.

Median housing price is not statistically significant in either of the San Francisco Bay Area models but is statistically significant and positive in the two Los Angeles models. In other words, in Los Angeles higher housing prices are associated with longer commute distances. Conceptually, this likely reflects sorting in the residential market. High housing prices make it difficult for some workers to self-select into neighborhoods located near their jobs. The exact mechanism at issue here with regard to residential sorting is not possible to identify without additional survey data measuring individual-level travel behavior and residential selection. In terms of effect size, the standardized coefficients show that the relative effect size of the housing cost variable in Los Angeles is considerably lower than the effect sizes of other variables. Housing prices are not associated with commute distance in the San Francisco Bay Area. This finding may be, in part, attributable to higher wages in the Bay Area, particularly for older workers, that allow more workers in the region to find housing closer to their worksites. It may also be attributable to overcrowding of residences in the most expensive areas that has occasionally led to high-profile tragedies such as the 2019 Ghost Ship Warehouse Fire (Paulas, 2018). Starting in 2019, some workers in the region may have benefited from the efforts of employers such as Google, Apple, and Facebook to invest in workforce housing (Schuetz, 2019), as a strategy to help recruit and retain talented labor, although these efforts would not have affected the data we used in this analysis.

The standardized coefficients on the wage and age ratios are among the largest across all of the models, indicating strong associations with observed variation in commute distances. With regard to the wage ratio, workers who work in areas with larger ratios of lower-wage to higher-wage workers tend to have shorter commutes. This finding likely reflects the relative value of travel time associated with workers of different wage groups. Workers who earn higher wages are able to afford longer commutes, and are likely to sort into specific employment niches that they hold on to even when they change residential locations. Lower-wage workers, by contrast, are more likely to hold lower-skilled jobs that require little training. They have less job attachment and, therefore, are more likely to change jobs when they relocate to minimize the costs of their commutes (Vejlin, 2013)(Vejlin, 2013). In any case, the net effect is that areas with higher ratios of lower-wage workers tend to have shorter commute distances than areas with relatively larger concentrations of higher-wage workers.

The age ratio of employed workers (the ratio of young to older workers) also has a statistically significant and positive relationship with commute distance. In this case, as suggested by our descriptive statistics, workers in neighborhoods with larger ratios of younger to older workers have longer—not shorter—commutes, even after controlling for other determinants of commute distance. Since we controlled for the wage ratio in our models, this finding is not a simple reflection of younger workers working lower- or higher-paying jobs. The underlying mechanism at work is impossible to identify with certainty given our data. However, the fact that this variable remains statistically significant for both age groups even after controlling for the wage structure of employment suggests that commute distances are statistically linked to the spatial location of jobs suitable for young workers, a finding similar to that of Hu and Schneider (2017) in their analysis of the commutes of low-wage workers. As the distribution of worksites by worker age suggests, younger workers may be more likely to work in more peripheral areas such as the port of Long Beach, northern Los Angeles County, and areas outside of major cities in San Francisco.

Distance from downtown also constitutes a statistically significant, positive, and relatively powerful predictor of commute distances, a finding that is consistent with other studies (Cervero & Wu, 1997; Zhu et al., 2022). Workers tend to travel farther to jobs that are located outside of job centers and dispersed throughout the metropolitan area. Workers also travel far to jobs located in employment clusters, in part facilitated by the transportation networks (e.g., highways, light rail, commuter rail) that facilitate travel into and out of downtowns. However, this variable contributes less to explaining commute distance than the distance variable. Still, the consistent relationship we find between the jobs-housing ratio and commute distances is remarkable when we consider that the variable explicitly indicating if a worker lives in an employment cluster is positive and significant across all models. Competition with other workers for housing thus seems to manifest in longer commute distances even after controlling for existing concentrations of employment.

Finally, all of the county-level dummy variables in our regression are statistically significant. Commutes to jobs located in Orange County tend to be shorter than commutes to jobs located in Los Angeles County, likely reflecting the sheer size of Los Angeles County relative to Orange County as well as the primacy of downtown Los Angeles relative to other employment centers in the region. Conversely, commutes to jobs in any of the San Francisco Bay Area counties outside of San Francisco County are associated with longer commute distances. Size likely plays a role here as well; San Francisco County is smaller in area than the peripheral counties. Moreover, while workers travel relatively far to access job centers, particularly downtown job centers, residential densities combined with a gentrifying population mean that some San Francisco workers may be able to self-select into neighborhood relatively close to their jobs.

As we note above, we tested the robustness of our results by constructing a parallel set of models using data from 2002. The sign, significance, and magnitude of the results for the 2002 models strongly resembled the results for the 2015 models. This continuity suggests that the theoretical relationships underlying our models remained similar over this time period.

Table 3. Commute Distance – Workers by Age and Metropolitan Area

Independent Variables	**Los Angeles MSA**				**San Francisco Bay Area MSA**			
	< 30		30-55		< 30		30-55	
	Coef (std. error)	Std. Coef.	Coef (std. error)	Std. Coef.	Coef (std. error)	Std. Coef.	Coef (std. error)	Std. Coef.
Intercept	0.097 0.206	0.000	0.964 0.182	0.000 ***	1.067 0.530	0.000 *	1.202 0.435	0.000 **
Median Home Value	0.138 0.016	0.144 ***	0.076 0.014	0.091 ***	0.033 0.038	0.027	0.022 0.031	0.019
Jobs-Housing Ratio (weighted)	0.071 0.012	0.106 ***	0.074 0.011	0.126 ***	0.128 0.027	0.150 ***	0.159 0.022	0.203 ***
Ratio: Lower- to higher-wage workers	-0.013 0.001	-0.187 ***	-0.014 0.001	-0.227 ***	-0.079 0.008	-0.286 ***	-0.092 0.006	-0.361 ***
Ratio: Younger to older workers	0.596 0.041	0.230 ***	0.479 0.037	0.212 ***	0.888 0.109	0.212 ***	0.689 0.090	0.180 ***
Distance from downtown	0.018 0.001	0.449 ***	0.014 0.001	0.411 ***	0.018 0.002	0.306 ***	0.017 0.002	0.301 ***
Employment cluster	0.120	0.081 ***	0.139 0.023	0.108 ***	0.183 0.059	0.101 **	0.155 0.048	0.093 **
County								
Orange	-0.163 0.023	-0.145 ***	-0.130 0.021	-0.133 ***				
Alameda					0.345 0.060	0.268 ***	0.435 0.049	0.368 ***
Contra-Costa					0.470 0.074	0.310 ***	0.557 0.061	0.401 ***
San Mateo					0.791 0.082	0.294 ***	0.789 0.067	0.319 ***
Marin					0.465 0.061	0.276 ***	0.517 0.050	0.334 ***
Adjusted R^2	0.303		0.283		0.405		0.523	

DISCUSSION

Our results provide evidence that competition for housing and, in Los Angeles, housing costs is associated with commute distance. More competition for housing near worksites means that available housing demand will outstrip housing supply, so many workers who are unable or unwilling to change employment sites must make longer commute trips. In Los Angeles, this competition for housing also manifests as higher housing costs in the most employment-accessible areas. Housing costs play a less direct role in shaping commute distances in the San Francisco Bay Area, perhaps due in part to high wages in the region that make housing absolutely more affordable for high-income workers, particularly those in the technology sector. Overcrowding of housing units that reduces the cost of living near employment sites may similarly serve to reduce housing costs near employers for low-income workers.

Our results also suggest a relationship between the age and wage structure of local employment and commute distance. Commute distances tend to be shorter in neighborhoods with a higher concentration of lower-wage workers. This finding is consistent with a large body of prior research (Blumenberg & King, 2019; Blumenberg & Siddiq, 2022; L. Hu & Schneider, 2017; Y. Hu et al., 2017) and theory that posits that low-wage workers have fewer incentives and capacity to undertake longer distance commutes (Alonso, 1964). Even holding worker wages constant, however, our results show that commute distances are longer in neighborhoods with a higher concentration of younger workers, potentially due to the location of these jobs within both regions.

We find a close relationship between urban spatial structure and commute distance. All else equal, commute distance is longer in areas farther from downtown and in areas located outside the dominant county in each MSA. This finding likely reflects a combination of higher employment densities, higher housing densities (i.e., more housing capacity), better public transit access, and higher-wage employment in the central areas of both MSAs. We also find that commute distances are longer into work tracts within employment clusters. In conjunction with our results highlighting the relationship between housing costs and competition and commute distance, our findings on the association between the economic geography of the regions and commute distance are consistent with those predicted by urban theory and previous research (Alonso, 1964; Blumenberg & Siddiq, 2022; Cervero & Wu, 1997).

CONCLUSION

Housing competition and, in Los Angeles, housing costs are associated with commute distances that are longer than they would be in less tight housing markets. Thus, underbuilding of housing units and the resulting higher costs for available units likely contributes to longer commute distances and, consequently, attendant congestion, pollution, and negative quality-of-life impacts. Because the location of housing relative to jobs is associated with commute distances, public policies that constrain housing production will incentivize vehicle miles of travel and the associated social costs. Conversely, policies to increase housing production, particularly those that promote new housing units adjacent to employment (e.g. upzoning, the lifting of minimum parking requirements), can help reduce commute travel and potentially increase travel by modes other than the automobile. Not all workers prefer to live close to where they work. Some workers may prefer to live close to their jobs but must balance their own residential location preferences with those of other household members. Therefore, on their own housing policies are not the solution to the negative externalities associated with automobile travel. Our research suggests, however, that they can contribute to reduced travel by enabling at least some households to self-select into neighborhoods in close proximity to their jobs.

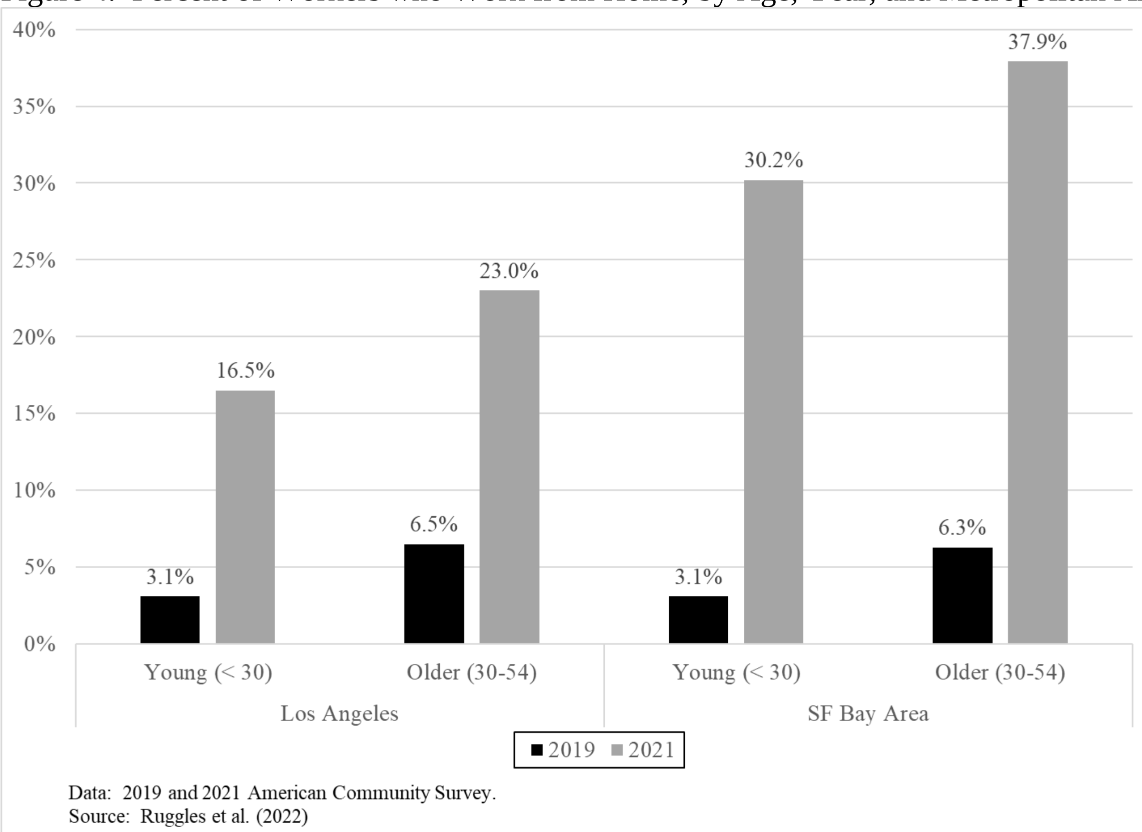
Jobs-housing patterns were interrupted by the COVID-19 pandemic. Many high-wage workers worked from home, prompting households and businesses to move from dense central business districts to the suburbs and driving up real estate demand in outlying areas (Ramani & Bloom, 2021). Two years out, data suggest lingering pandemic effects. A recent article in *The New York Times* (Dougherty & Goldberg, 2022) reported that office buildings in San Francisco remained at only 40 percent of their pre-pandemic occupancy, as employers in the high-wage technology industry continued to allow their workers to work from home. The longer-term implications of these changes for the relationship between housing, commute distance, and worker age are unclear but, based on current data, will likely vary by age and metropolitan area.

As the article in *The New York Times* reports, many workers still work from home and at rates significantly higher than prior to the pandemic. Figure 4 shows the percentage of workers who *primarily* work from home by age, year, and metropolitan area (Los Angeles and the San Francisco Bay Area).[3] From 2019 to 2021, work-at-home rates increased among all workers; however, by 2021 rates remained higher among older workers compared to younger workers and in the San Francisco Bay Area compared to Los Angeles. The impact of telecommuting on travel distance is difficult to predict. Absent other factors (such as the COVID pandemic), at best telecommuting appears to have a modest negative effect on vehicle miles of travel (Choo et al., 2005). However, there may be a positive association between telecommuting (defined as workers who telecommute at least once per week) and personal miles of travel (Zhu, 2012). As

[3] The American Community Survey ask respondents for their primary means of transportation to work over the course of the previous week. The rates of work from home are significantly higher among workers who may regularly work from home but only part time.

we saw during the pandemic, telecommuting enables residential location in outlying neighborhoods where distance to jobs (to which workers may have to report at least occasionally) and other non-work destinations are greater than in dense urban areas.

Figure 4. Percent of Workers who Work from Home, by Age, Year, and Metropolitan Area



The increase in workers who spend much of their days at home will likely stimulate new economic activity in outlying areas (Dougherty & Goldberg, 2022; Kahn, 2022). At the same time, increased demand for suburban housing generated significant increases in housing prices in, what once was, more affordable suburbs, smaller cities, and neighborhoods distant from high-cost, high-density urban downtowns (D'Lima et al., 2022; Li & Zhang, 2021), perhaps suggesting a growing role for jobs-housing balance in relation to commute distance in suburban areas.

COVID-related trends may produce greater divergence by age than we found in our analysis. As Figure 4 shows, younger workers are less likely than older workers to telecommute and, therefore, may have a greater preference for living close to their jobs. Moreover, the softening of housing prices in some central cities will likely attract young adults drawn to the amenities, face-to-face interaction, and excitement that are part-and-parcel of urban life (Kahn, 2022). Blumenberg and Wander (2022) find that jobs-housing balance is not associated with commute distance in more affordable metropolitan areas in California (Blumenberg & Wander, 2022). However, the ongoing affordable housing crisis in the state—particularly dire in the two metropolitan areas analyzed in this study—means that housing prices remain high and out of reach for many residents (Federal Reserve Bank of Atlanta, 2022; Joint Center for Housing Studies, 2022; Xu & Hale, 2022). For example, among U.S metropolitan areas with populations greater than 500,000, the Los Angeles and San Francisco Bay Area were the least affordable with respect to home ownership (Federal Reserve Bank of Atlanta, 2022). With respect to rents, Realtor.com has the Los Angeles metropolitan area as one of the least affordable metropolitan areas in the country, second only to Miami (Xu & Hale, 2022). To address the housing crisis, the California Department of Housing and Community Development (2022) has called for the production of 2.5 million new homes over the next eight-years, of which no less than one million must meet the needs of lower-income households. Failure to meet these goals likely means an ongoing role for jobs-housing balance in shaping the commutes of workers in high-housing-cost metropolitan areas.

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