# Moving to Density: Half a Century of Housing Costs and Wage Premia from Queens to King Salmon

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**Abstract**

Have workers stopped moving to the highest-density, highest-productivity places in the country because of a decline in the urban wage premium, or because the rent is too high? We analyze how important these two explanations are by studying them in one and the same empirical analysis. We find that that non-college workers now effectively face a housing-inclusive urban wage penalty, while workers with college education continue to face a significant urban wage premium. We relate these findings to the share of native-born cross-state migrants across different parts of the country, and find that native-born cross-state migrants, especially non-college workers, have become less likely to live in the highest-productivity areas.

**Keywords:** Density, Housing, Migration, Skills, Wages

**JEL:** J24, J31, J61, R21, R31, R53

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Economists have long recognized the tendency toward a bifurcated labor market marked by the disappearance of middle-skill occupations in both manufacturing and services jobs (e.g. Autor, Katz, and Kearney, 2006). There is an important spatial dimension to this development. For example, Baum-Snow and Pavan (2013) find that the variance of log wages in the United States would have grown by 23% less between 1979 and the global financial crisis if wage inequality evolved everywhere the way it did in rural areas. Following Eeckhout et al. (2014), one might argue that this (growing) urban inequality premium is a natural consequence of (increasing) extreme-skill complementarities. In his 2019 Ely Lecture, David Autor argues that urban labor markets have, indeed, gone through a more dramatic version of the process of polarization that has marked the labor market as a whole (Autor, 2019). Autor argues that this process of "differential polarization," driven by automation and international trade, has eroded the traditional urban wage premium for non-college workers. He concludes that this may well explain the reduced flow of cross-state migrants to the highest-income parts of the United States documented by Ganong and Shoag (2017).[1] Davis et al. (2020) develop a theory of this process of spatially differentiated labor market polarization and show that its predictions hold in a sample of 117 French cities.

An alternative explanation that has been proposed for the reduction in domestic migration flows in recent decades is, instead, the rapid increase in the price of housing in precisely the highest-productivity parts of the country. This rapid price increase, in turn, is said to have been fueled by restrictions on the supply of housing (Glaeser et al., 2006; Ganong and Shoag, 2017; Hsieh and Moretti, 2019). Because housing expenditures constitute a larger part of their budget for non-college workers, this would have had the consequence of disproportionately locking them out of high-productivity places (Ganong and Shoag, 2017).

These two explanations, while potentially complementary, have starkly different implications

[1]College workers have attended any number of years of post-high school education and non-college workers hold only a high school diploma or less.

for policymakers. The former suggests that a lack of spatial arbitrage is not the problem here: non-college workers can now do the same work in less dense parts of the countries that they can do in the densest cities. The latter, on the other hand, implies that reducing supply restrictions would lead to reductions in spatial misallocation with significant macroeconomic effects (Hsieh and Moretti, 2019).

In this paper we set out to determine how important these two explanations are by studying them in one and the same empirical analysis. After discussing our data, we show how the urban wage premium has changed over the past 50 years if housing costs are taken into account and find that non-college workers now effectively face a housing-inclusive urban wage penalty, while college workers continue to face a significant urban wage premium. We relate these findings to the share of native-born cross-state migrants across areas of different productivity levels, and confirm that domestic migration patterns have been reshaped accordingly for non-college workers but not for college workers. An explanation for this pattern of findings may lie in non-housing geographical cost of living differences, as documented by Diamond and Moretti (2021).

## 1 Data

Our analysis is organized around snapshots from 1970, 1980, 1990, 2000, 2010, and 2019. We use public-access microdata from the United States Census and the 5-year pooled American Community Survey (ACS) to build a stable panel of wages, housing costs, and migration in commuting zones between 1970 and 2019.[2] Decennial census data are used for 1970, 1980, 1990, and 2000 and the 2006 to 2010 and 2015 to 2019 pooled ACS are used for 2010 and 2019.[3] We rely on crosswalk files from Dorn (2009) to map individuals in each observation year to 1990 commuting zones. This process maps county groups in 1970 and 1980 and then public use micro areas (PUMAs) from 1990 onwards to 722

[2]The 1% metro sample is used in 1970 and the 5% state sample is used for 1980 to 2000. Due to the post-Hurricane Katrina population displacement in Louisiana in 2011, 2,688 observations are assigned to PUMA 77777. We have not included those observations in this analysis.

[3]These data are accessed using IPUMs (Ruggles et al., 2019).

commuting zones, creating a balanced panel that covers the entire contiguous lower 48 states.[4]

We calculate commuting zone densities in 1970 using total area measures from Autor (2019) and population estimates from the 1970 census used above. This measure does not vary by year and is fixed for our 722 commuting zone panel in each of the six observation years.[5] To measure area productivity, we use average log hourly wages and the average log hourly wages less housing costs for workers of all skill levels in each commuting zone. These measures are allowed to vary in each observation year, unlike commuting zone density.

We are primarily interested in the disparate outcomes for workers in different skill groups. Education is used as a proxy for skill to divide our sample into two mutually exclusive groups: "college" and "non-college". College workers have attended any number of years of post-high school education and non-college workers hold only a high school diploma or less. We limit our sample to working-aged adults — ages 16-64 — who have an annual inflation-adjusted wage and salary income of at least $112 per week in 2000 USD.[6] The personal consumption expenditure chain-type price index (PCEPI) is used throughout this article.

On the outcome side we primarily focus on wage and salary income (referred to simply as "wages"), housing costs, and wages less housing costs. To measure individual wages, we use reported wage and salary income, deflate this value by the PCEPI, and then scale it to be hourly by dividing by 48 weeks worked and 40 hours of work per week. This scaling makes our findings easily interpretable and changes in hours worked over time is not the focus of this paper.[7] We use reported monthly rent and home values to approximate housing costs. Following Ganong and Shoag (2017), we use 5 percent

[4]The crosswalks in Dorn (2009) essentially split individuals that are in a PUMA or county group that is in multiple commuting zones and then alter the weights provided by IPUMS accordingly. The observations from 2010 in the five year pooled ACS require using 2000 PUMAs rather than 2010 PUMAs when mapping observations to commuting zones.

[5]Similarly to Autor (2019) we find that allowing commuting zone densities to update over time does not meaningfully changes our results.

[6]Our decisions on sample restrictions are match those underlying Autor (2019) Figure 13.

[7]There is no consistent measure of hours worked available throughout our sample years. Instead we use reported annual measures of wage and salary income and housing costs available from stable questions in the Census and ACS and scale them to match Autor (2019), Figure 13.

of total home value for home owners or 12 times the monthly rent for renters as a measure of annual housing costs.[8] This measure of housing costs is then scaled to be hourly to be more easily compared with wages. Our third outcome measure is wages less housing costs, which we obtain by simply subtracting hourly housing costs from hourly wages. For all three of these outcome measures we use log transformation of individual observations. These are then averaged to the 1990 commuting zone level.

The final outcome variable of interest here is migration. In order to measure internal directed migration of individuals we focus on cross-state native-born migrants. We define these as workers who were born in the United States and whose state of birth does not match their state of residence. These internal flows of individuals may drive spatial adjustments to productivity shocks as noted in Blanchard and Katz (1992) that would follow from a directed migration model as proposed by Ganong and Shoag (2017).

## 2 What Has Happened to the Urban Wages-After-Housing Premium?

The urban wage premium for low-skilled workers declined between 1970 and 2019, as documented by Autor (2019). Figure 1 shows how the relationship between average wages and density at the commuting zone level has changed over time for college and non-college workers. In this figure, the urban wage premium is represented by the slope of the regression lines for college and non-college workers; a positive (negative) slope reflects a positive (negative) wage premium (penalty) in high density areas. These OLS regressions are run separately for college and non-college workers in each observation year and take the following form:

$$HourlyWage_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i \quad (1)$$

[8] Using monthly rent and home values to construct housing costs limits our sample to individuals for which these data are available. We find that this limitation does not meaningfully impact our estimation of wages.

where $HourlyWage_i^{gt}$ is the average log hourly wage for in 1990 commuting zone $i$ for skill group $g$ in observation year $t$. $CZDensity1970_i$ is the commuting zone population per square mile in 1970. The coefficient $\beta$ is represented by the slope of the fitted regression equation in each panel and reflects the urban wage premium.

For college workers, shown in blue, the steep gradient of the slope relating wages to prior density shows that the wage premium has remained large over the past half century. A back-of-the-envelope calculation may be helpful in interpreting the size of the wage premium here: whether one moves from 2.7 to 3.1 on the log scale, as in the 1970 panel, or from 2.9 to 3.3, as in the 2019 panel, hourly wages increase by some 50%. On the other hand, workers with only a high school degree or less, shown in red, have seen their wage premium in dense areas decline, especially after the year 2000, from about 35% in 1970 to 10% in recent years. This decrease in high-density wages for low-skilled workers makes migration toward high-density areas less attractive for such workers, ceteris paribus.

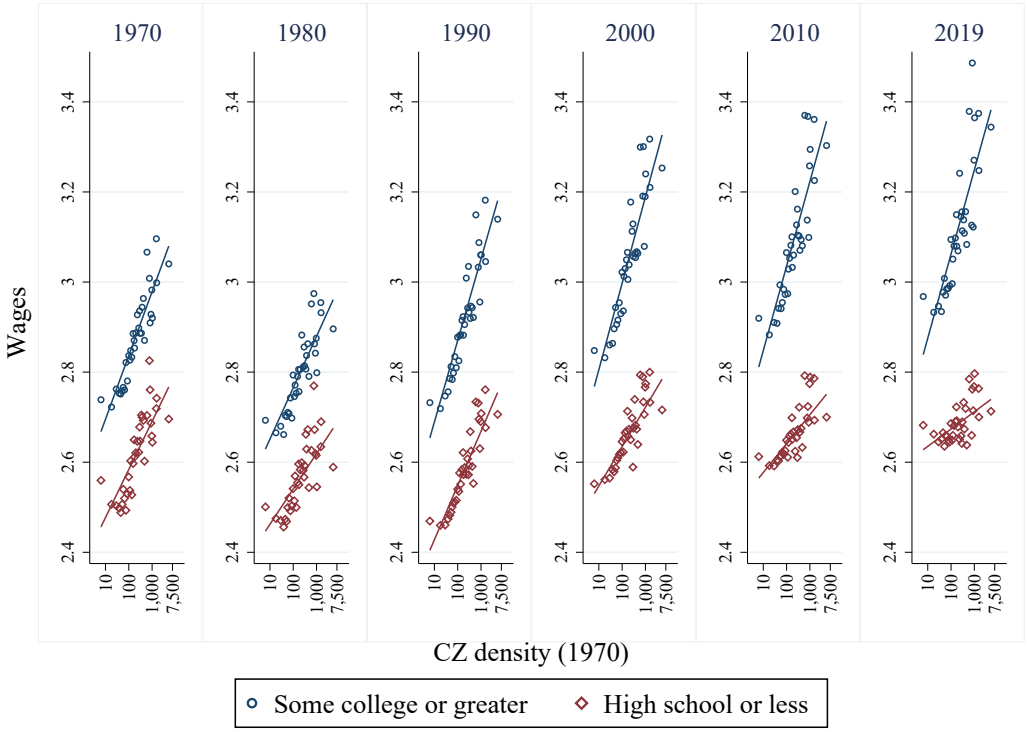
But not all is equal, and spatial equilibrium results from more than a simple comparison of wage levels. A key source of spatial variation on the spending side is the cost of housing, as emphasized in Ganong and Shoag (2017). The "urban housing cost premium" has increased for all workers between 1970 and 2015, but to a greater degree for workers with only a high school degree or less.[9]

To better understand the implications of these changes for workers and the housing-inclusive urban wage premium, we show the relationship between wages less housing costs and commuting zone density in Figure 2. The figure shows estimates of separate regression equations for college and non-college workers in each observation year that have the following form:

$$WagesLessHousing_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i \quad (2)$$

[9]Figure A.1 illustrates this. While housing expenditures as a share of wages have gone up across the density spectrum and for both categories of workers, increases have been draconian for non-college workers in the densest areas.

Figure 1: Hourly Wages by Skill Group and Density




Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately in each observation year: $HourlyWage_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $HourlyWage_i^{gt}$ is the average log hourly wage for group $g$ in commuting zone $i$. Wages are annual total wages and salaries divided by 40 hours and 48 weeks worked to match Autor (2019). The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

where $WagesLessHousing_i^{gt}$ is the average of the log of the difference between hourly wages and hourly housing costs for workers in skill group $g$ in 1990 commuting zone $i$ and year $t$. $CZDensity1970_i$ is the commuting zone population per square mile in 1970. The coefficient $\beta$ is represented by the slope of the fitted regression equation in each panel reflects the urban wage premium.

Incorporating housing costs does not change the steep urban wage premium facing workers with at least some college much. However, non-college workers saw that housing-inclusive premium starting to erode during the 1980s, before watching it turn into an urban wage penalty of over 10% between 2000 and 2019. This means that not only have relative wages decreased dramatically for non-college workers in dense areas, their housing costs have escalated as well.[10]

The erosion of the urban wage premium has had serious consequences for low-skilled workers.[11] The blue lines in Figure 2 show that wages less housing costs for college workers have risen over time, in real terms, for all densities. The red lines show that, in 1970, non-college workers could expect a housing-inclusive wage premium of 10% when moving from the $25^{th}$ percentile of commuting zone density to the $99^{th}$ percentile of commuting zone density. In 2019, that same move would instead be associated with an urban penalty of over 10%. The wage gradient is not only negative in 2019, but at all densities non-college workers are worse off in real terms in 2019 than at any other point since 1970.[12] These findings raise the question: what is the relative importance of wages and housing costs for understanding changes in the urban wages less housing cost premium?

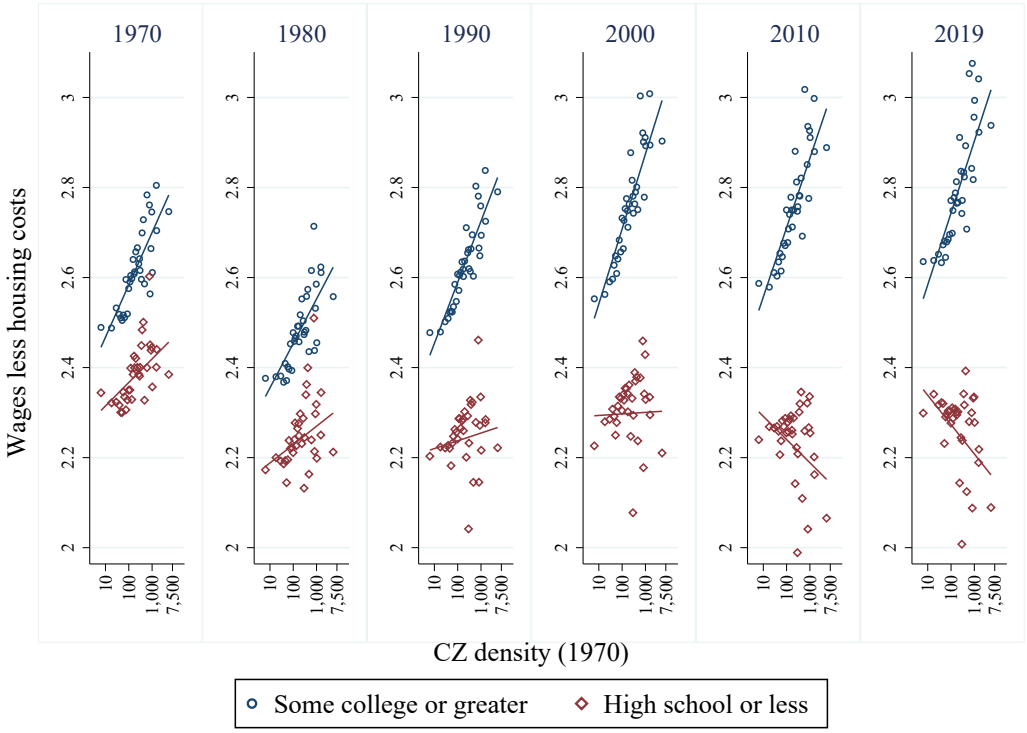
In Table 1 we explore the changes in real wages and real wages less housing costs between 1970

[10]Figure A.2 shows the change in housing costs by density over time. The 1980s witnessed a notable increase in high-density areas as well as a notable decrease in low-density areas, followed by significant increases at most densities ever since.

[11]In Table A.1 we show estimates of wages less housing costs for college and non-college workers from Figure 2 at select points in the density distribution. The unincorporated community of King Salmon, California is part of the low-density Eureka commuting zone (16 people per square mile), while the New York City borough of Queens in part of the highest-density one (5,219 people per square mile). For a few examples of well-known towns and cities at various density levels, please refer to Table A.2.

[12]We explore how our findings in Figure 2 change when we divide the labor force by income percentiles instead of by education as well as when we take differences in housing quality, housing unit ownership, and household composition into account in Figures A.3 to A.9 and find our findings to be robust.

Figure 2: Wages Less Housing Costs by Skill Group and Density




Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately in each observation year: $WagesLessHousing_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $WagesLessHousing_i$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

and 2019 for college and non-college workers at select commuting zone densities. Column 1 presents changes in estimates from Equation 2 and Column 2 presents changes in estimates from Equation 1. Column 3 shows the ratio of the changes in estimates from Column 2 to those from Column 1, that is, the ratio of the change in wages to the change in wages less housing. Interpreting this ratio in Panel A, which deals with workers with some college or greater, is straightforward: the greater the ratio, the more wage growth has outpaced housing cost growth. For workers with some college or greater wages have consistently increased at all density levels and at a faster pace than housing costs. In Panel B, we see that the experience of workers with a high school degree or less has been markedly different. Most wage growth has occurred at and below the median density commuting zone, but as we see from the negative ratios, not enough to keep up with housing cost increases. At the $50^{th}$, $75^{th}$, $90^{th}$, and $95^{th}$ percentiles wages, before deducting housing costs, have grown by less than $1 between 1970 and 2019. That said, housing costs have increased faster, and the ratios in this range are consistently negative.

The estimates in Table 1 show, for both educational groups and all densities, that the increasing cost of housing has had an impact on the housing-inclusive urban wage premium that is of a similar magnitude as that of the structure of the labor market. The overall finding, for non-college workers, of a decreasing and then negative housing-inclusive urban wage premium both amplifies Autor (2019)'s message and suggests that housing is key to understanding broader trends in migration and the geographic distribution of demand for skills.

Now, thus far we have only considered the declining urban wage premium in the context of density. However, one would expect directed migration to flow toward productive areas, not necessarily dense ones. Although productivity and density are related, they are not the same. Some very productive places are, relatively speaking, not very dense. Perhaps the best example is San Jose, CA, which includes Silicon Valley and at 226 people per square mile has a density below the median.

Figure 3 looks at how wages less housing costs have changed for college and non-college work-

Table 1: Comparison of Changes in Wages Less Housing Costs and Wages by Commuting Zone Density Between 1970 and 2019 (2012 USD)

| **Panel A** | | **Some college or greater** | | |
|---|---|---|---|---|
| Percentile | Pop per sqr. mile | Δ Wages less housing | Δ Wages | $\frac{\Delta Wages}{\Delta Wageslesshousing}$ |
| | | (1) | (2) | (3) |
| $5^{th}$ | 22 | $1.71 | $3.34 | 1.95 |
| $10^{th}$ | 39 | $1.92 | $3.69 | 1.92 |
| $25^{th}$ | 79 | $2.19 | $4.14 | 1.89 |
| $50^{th}$ | 255 | $2.69 | $4.99 | 1.86 |
| $75^{th}$ | 623 | $3.11 | $5.69 | 1.83 |
| $90^{th}$ | 1,526 | $3.57 | $6.48 | 1.82 |
| $95^{th}$ | 1,572 | $3.58 | $6.51 | 1.82 |
| **Panel B** | | **High school or less** | | |
| Percentile | Pop per sqr. mile | Δ Wages less housing | Δ Wages | $\frac{\Delta Wages}{\Delta Wageslesshousing}$ |
| | | (1) | (2) | (3) |
| $5^{th}$ | 22 | -$0.16 | $1.78 | -11.13 |
| $10^{th}$ | 39 | -$0.46 | $1.58 | -3.43 |
| $25^{th}$ | 79 | -$0.83 | $1.33 | -1.60 |
| $50^{th}$ | 255 | -$1.43 | $0.88 | -0.62 |
| $75^{th}$ | 623 | -$1.90 | $0.52 | -0.27 |
| $90^{th}$ | 1,526 | -$2.36 | $0.14 | -0.06 |
| $95^{th}$ | 1,572 | -$2.37 | $0.12 | -0.05 |

Note: This table uses data from the 1970 and data from the 5-year pooled ACS for 2015-2019 to compare changes in estimates of regressions of the following form between 1970 and 2019 for college and non-college working-age adults separately:

$$W_i^{gt} = \alpha + \beta * ln(CZDensity)_i + \varepsilon_i$$

where $W_i^{gt}$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$ in **Column 1**. Wages are annual total wages and salaries divided by 40 hours and 48 weeks worked to match Autor (2019). Housing costs are measured as 5 percent of home values or 12 times monthly rent following Ganong and Shoag (2017). In **Column 2** $W_i^{gt}$ is replaced with the average hourly wage for skill group $g$ in year $t$ for 1990 commuting zone $i$. Skill groups $g$ include college, which means individuals with any education above a high school degree, and non-college, which means individuals with high school or less. The difference between wage and salary income and housing costs is deflated by the US Bureau of Economic Analysis Personal Consumption Expenditures Chain Price Index and then the natural log is take for each individual and averaged at the commuting zone level. $CZDensity_i$ is the 1970 population per square mile for 1990 commuting zone $i$. $\varepsilon_i$ is an error term. Changes in estimates between 1970 and 2019 are presented for select commuting zone percentiles and **Column 3** presents the ratio of the changes in wages over the changes in wages less housing costs. **Panel A** shows changes for workers who attended some college or greater. **Panel B** shows the same changes for workers who did not attend any college and therefore have only a high school degree or less. The sample includes only working aged adults from age 16 to 64 who make more than $112 per week in 2000 USD. Observations are matched with 1990 commuting zones following the matching procedure in Dorn (2009) to create a stable 722 commuting zone panel. Changes reported in the table have had the natural log operator removed to give average estimates by commuting zone density in 2012 USD.

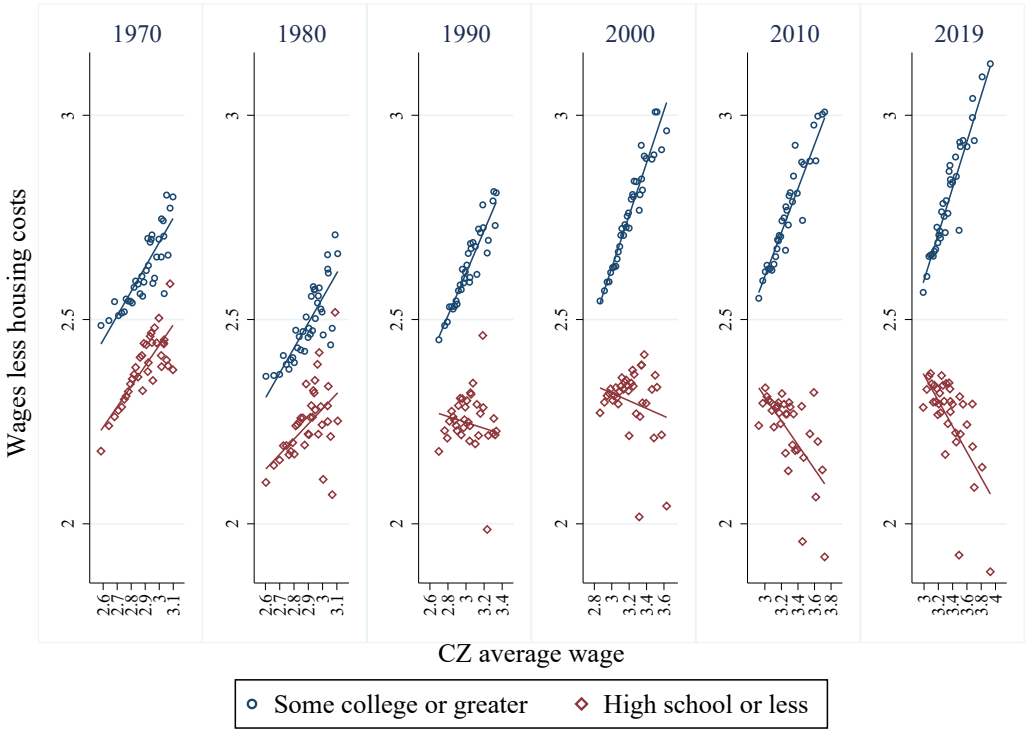
ers in different commuting zones, but instead of ordering commuting zones by population density in 1970, we order them by current-year productivity, as measured by the average wage for all workers in the commuting zone. We run regressions of the following form for college and non-college workers separately in each year:

$$WagesLessHousing_i^{gt} = \alpha + \beta * ln(Productivity)_i + \varepsilon_i \quad (3)$$

where $WagesLessHousing_i^{gt}$ is the average of the log of the difference between hourly wages and hourly housing costs for workers in skill group $g$ in 1990 commuting zone $i$ and year $t$. $Productivity_i$ is the average log hourly wage for all workers in 1990 commuting zone $i$. Unlike density, which is fixed in 1970, we recalculate this measure in each observation year for all 722 commuting zones. The coefficient $\beta$ is represented by the slope of the fitted regression equation in each panel and reflects the urban wage premium.

Reminiscent of Figure 2, the blue line in Figure 3 shows that college workers continue to see a sizable housing-inclusive wage premium in high-productivity areas. As for non-college workers, the wage premium in high-productivity areas is eliminated by 1990 and by 2010 they face a wage penalty in the areas with the highest overall wages. This confirms the pattern we established for areas with different densities.

Figure 3: Wages Less Housing Costs by Skill Group and Productivity




Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately in each observation year: $WagesLessHousing_i^{gt} = \alpha + \beta * ln(Productivity)_i + \varepsilon_i$, where $WagesLessHousing_i^{gt}$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $Productivity_i$ is the overall wages for all working aged people in commuting zone $i$ for each observation year. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

## 3 Moving to Density

We now turn to how the above documented changes in wages and housing costs relate to domestic migration. We are interested in migration that is driven by spatial differences in economic conditions within the United States rather than cross-country migration. Therefore, our focus is on native-born cross-state migrants, working-age individuals who live outside of their state of birth.

Relating cross-state migrant shares to commuting zone wages less housing costs produces a picture similar to Figure 3. Figure 4 shows the share of native-born cross-state migrants separately for college and non-college workers for each commuting zone. Some commuting zones, such as Washington, DC, may attract differently skilled migrants because of their high initial shares of college workers in 1970. To account for this, we classify the commuting zones with the highest share of workers with any college in 1970 as high college commuting zones and commuting zones with the lowest shares of workers with any college in 1970 as low college, with roughly half of all college workers in each group. Then, we plot shares of cross-state migrants against average wages less housing costs for workers in each year separately for commuting zones with high college shares in 1970 (top panel) and low college shares in 1970 (bottom panel).[13]

The figure shows regressions run separately for college and non-college migrant shares in each observation year across two figures that take the following form:

$$CrossStateMig_i^{gts} = \alpha + \beta * ln(WagesLessHousing)_i + \varepsilon_i \tag{4}$$

where $CrossStateMig_i^{gts}$ is the share of native-born cross-state migrants of working-age adults within group $g$ in commuting zone $i$ in year $t$ and in commuting zone group $s$. $WagesLessHousing_i$ is the

[13] In Figure 4 we fix the classification of commuting zones as high college share or low college share in 1970, but allowing this division to update each sample year produces very similar results.

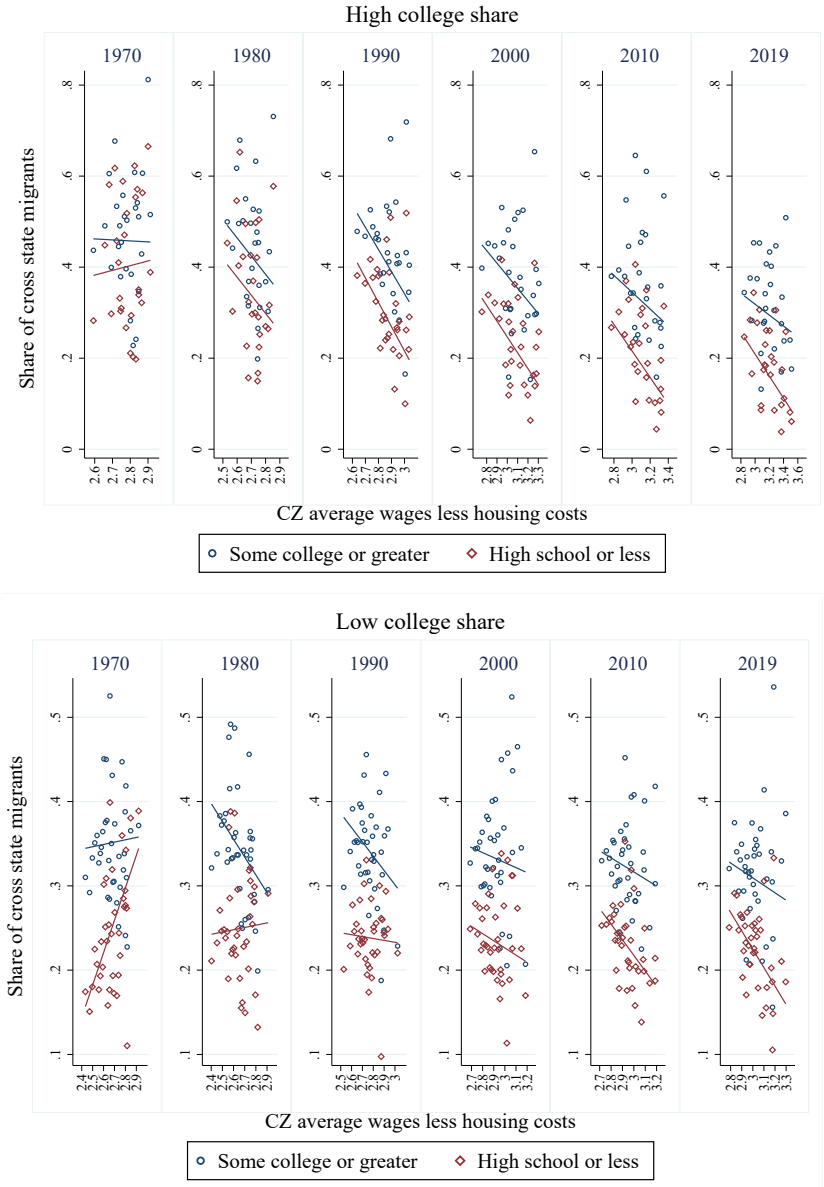
overall wages less housing costs for all working aged people in commuting zone $i$ for each observation year. Unlike density, which is fixed in 1970, we recalculate this measure in each observation year for all 722 commuting zones. The coefficient $\beta$ is represented by the slope of the fitted regression equation in each panel and reflects the relationship between commuting zone wages less housing costs and migration. These estimates look very similar if we do not subtract housing costs and simply plot community zones by average-wage level: for the purposes of our discussion one can generally think of the community zones with high levels of wages less housing costs as high-productivity areas and vice versa, and we will do so below.

In 1970 the share of cross-state migrants in high-productivity commuting zones is much greater than the share of cross-state migrants in low-productivity commuting zones. This disparity was mostly driven by non-college workers who migrated towards high-productivity commuting zones with a low share of college workers. This disparity grew smaller over time before inverting entirely. The relationship between productivity and cross-state migrant share had turned negative for both college and non-college workers by 1990. This negative relationship has only strengthened since then.[14] It holds for commuting zones with both high and low shares of college workers in 1970, suggesting that it is not a product of different initial conditions.

For non-college workers this pattern is largely consistent with what one would expect based on Figure 3. The tight positive relationship between area productivity and wages less housing costs for non-college workers in 1970 would lead one to expect a larger cross-state migrant share in high-productivity areas. As this relationship erodes and becomes negative, migrant shares should shift accordingly, which is what Figure 4 shows. For college workers the change in the relationship between productivity and migrant share is not as stark, but still surprising given the persistent wage premia depicted in Figure

[14]Figure A.10 replicates Figure 4 using all commuting zones in one group and commuting zone density on the horizontal axis.

Figure 4: Native-Born Cross-State Migrants as Share of Skill Group by Wages Less Housing Costs




Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults and for low college and high college commuting zones separately in each observation year: $CrossStateMig_i^{gts} = \alpha + \beta * ln(WagesLessHousing)_i + \varepsilon_i$, where $CrossStateMig_i^{gts}$ is the share of native-born cross-state migrants within group $g$ in commuting zone $i$ and in commuting zone group $s$. The two groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Commuting zones are split into high college share commuting zones in 1970 and low college share commuting zone in 1970, with roughly half of all college workers in each group. Cross-state migrants are identified as individuals not residing in their state of birth. $WagesLessHousing_i$ is the overall wages less housing costs for all working aged people in commuting zone $i$ for each observation year. Wages are annual total wages and salaries divided by 40 hours and 48 weeks worked to match Autor (2019). Housing costs are measured as 5 percent of home values or 12 times monthly rent following Ganong and Shoag (2017) and divided by 40 hours and 48 weeks to be hourly. Wage and salary income and housing costs are deflated by the US Bureau of Economic Analysis Personal Consumption Expenditures Chain Price Index. The sample includes only working aged adults from age 16 to 64 who make more than $112 per week in 2000 USD. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

3.[15] This paradox may be partially resolved by non-housing geographical cost of living differences, as documented by Diamond and Moretti (2021).

While we do not want to attach aggressively causal interpretations to this exercise, these figures suggest that the elevated cost of housing in high-productivity areas is a particularly important obstacle - and perhaps a proxy for other important obstacles - to spatial mobility.

## 4 Conclusion

Americans have become less mobile over the past few decades (Molloy et al., 2017), as the dynamics implied by notions of spatial equilibrium continue to shape the nation's economic geography. Our results suggest that the decline in the urban wage premium for non-college workers has been especially steep once housing costs are taken into account. This has had dramatic consequences for the attractiveness of high-density areas: for non-college workers, there is now, on average, an urban wage penalty after accounting for the cost of shelter. We highlight in particular that this is the result of the confluence of two factors of similar quantitative importance: the decline in the pure urban wage premium, as well as rapid increase in housing costs. None of this, of course, means that no non-college workers will choose to move to dense areas, as significant within-group heterogeneity remains.

A better understanding of the drivers of changes in urban labor markets is important as we ponder what work of the future will look like for low-skilled workers in those areas. At the same time, continued access to these urban labor markets requires that we address the increasing barriers to labor market mobility faced by workers of all skill levels. Such access is a precondition for both the ongoing realization of agglomeration economies and the widespread enjoyment of their fruits.

[15] Figure A.11 shows that cross-state migrants among both college and non-college workers receive housing-inclusive wages that exceed those of non-migrants, to the point where the decline in the urban wage premium is barely apparent even among the non-college workers among them. This highlights that spatial sorting is impacted by moving costs and other frictions in addition to commuting zone wages and housing costs.

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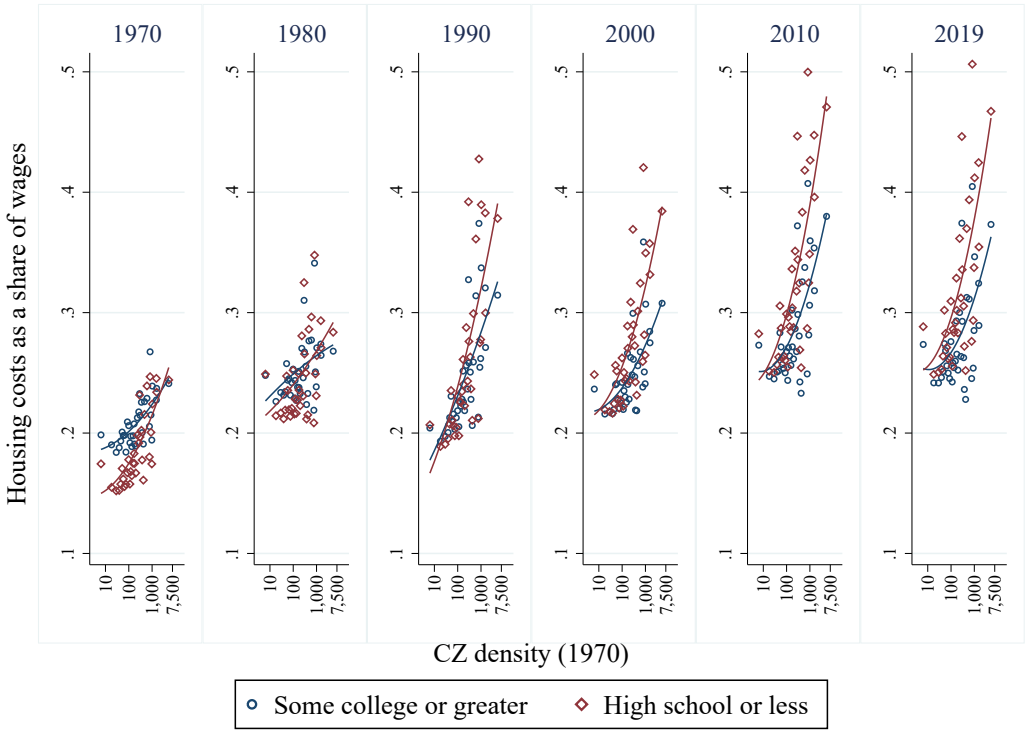
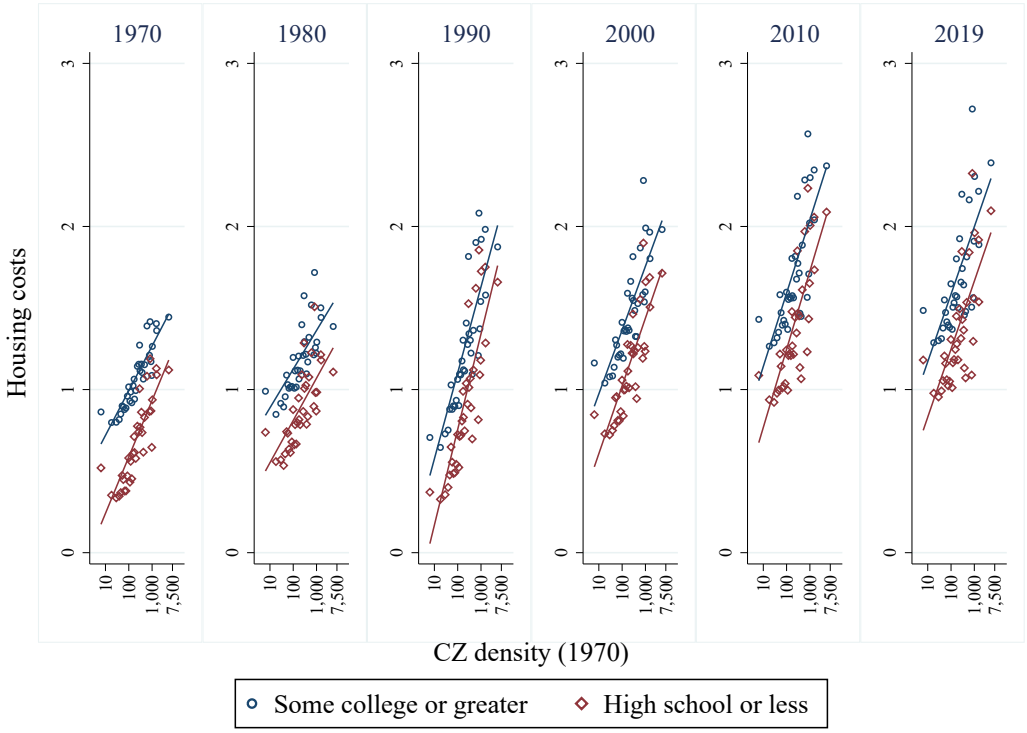
Figure A.1: Housing Costs as a Share of Hourly Wages by Skill Group and Density



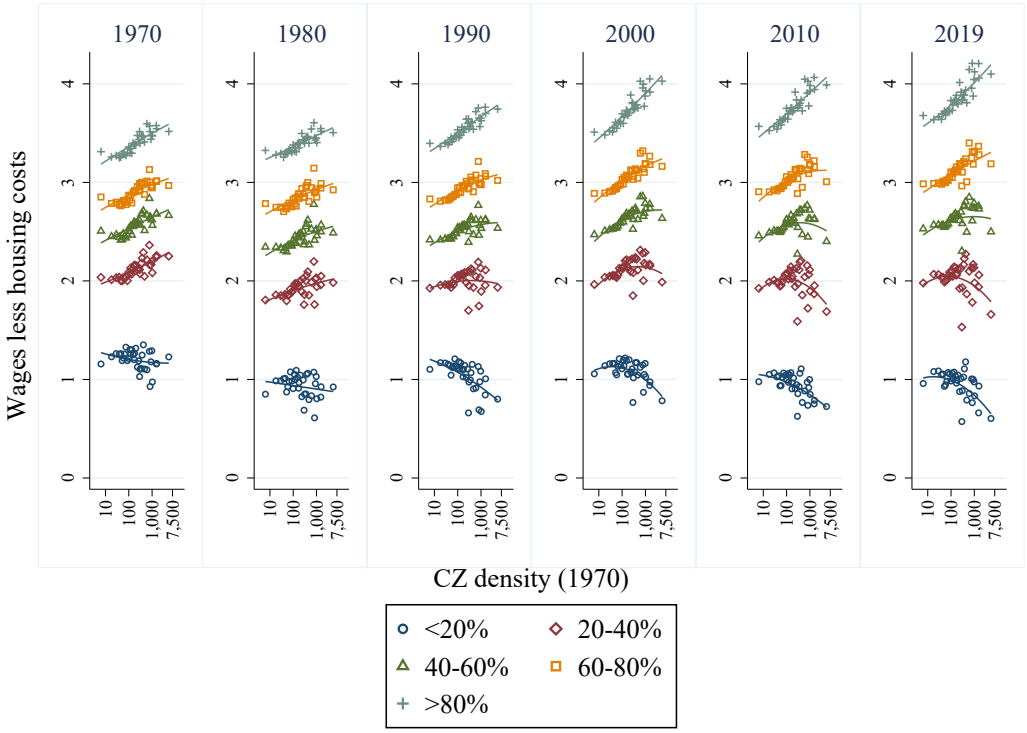

Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately in each observation year: $HousingShare_i^{gt} = \alpha + \beta_1 * ln(CZDensity1970)_i + \beta_2 * (ln(CZDensity1970)_i)^2 + \varepsilon_i$, where $HousingShare_i^{gt}$ is the average hourly housing cost as a percentage of hourly wages for skill group $g$ in year $t$ for 1990 commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) and wages are total income from wages and salaries. Both income and housing costs are divided by 40 hours per week and 48 weeks worked to reflect hourly earnings and costs. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.2: Hourly Housing Costs by Skill Group and Density



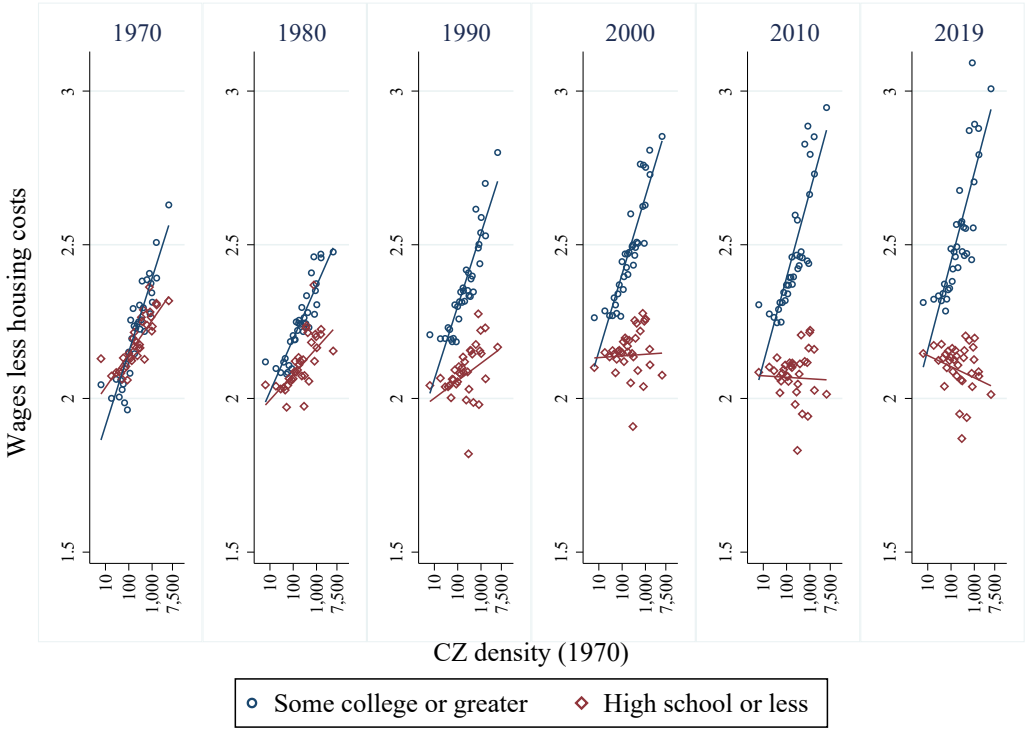

Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately in each observation year: $HourlyHousing_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $HourlyHousing_i^{gt}$ is the average log hourly housing costs for group $g$ in commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.3: Wages Less Housing Costs by Income Quintiles and Density



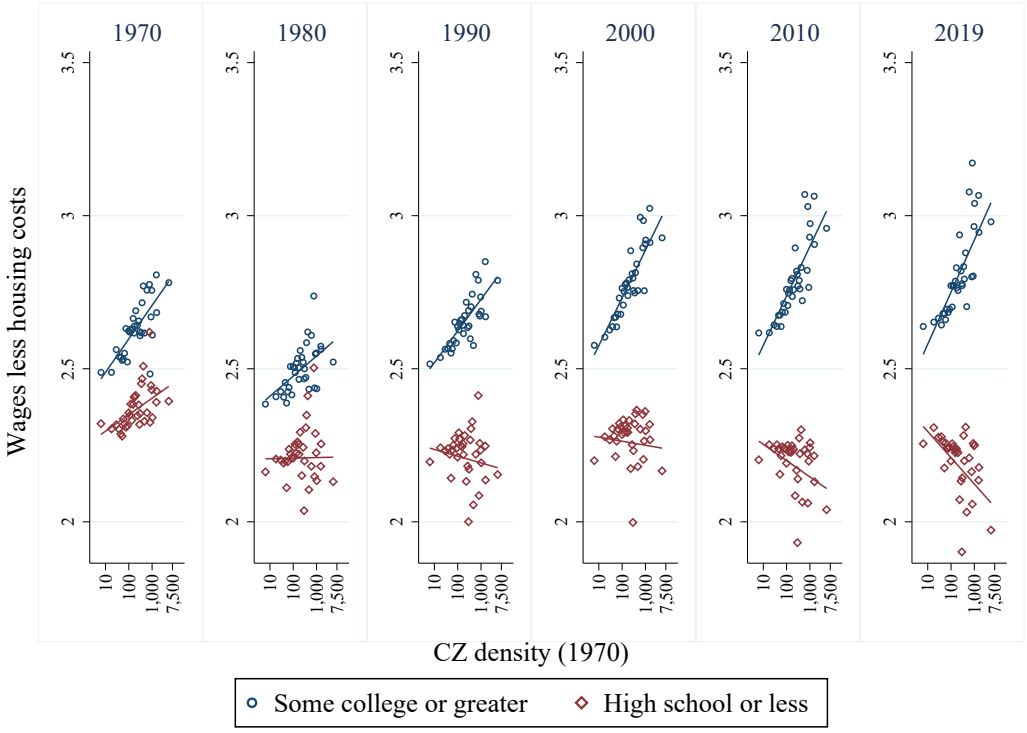

Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for working-age adults in different income quintiles separately in each observation year: $WagesLessHousing_i^{qt} = \alpha + \beta_1 * ln(CZDensity1970)_i + \beta_2 * (ln(CZDensity1970)_i)^2 + \varepsilon_i$, where $WagesLessHousing_i$ is the average hourly wage less housing costs for income quintile $q$ in year $t$ for 1990 commuting zone $i$. The income quintiles are determined for each observation year using the average wages for all working aged adults. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.4: Wages Less Housing Costs by Skill Group and Density for Workers Living in Two Bedroom Housing Units



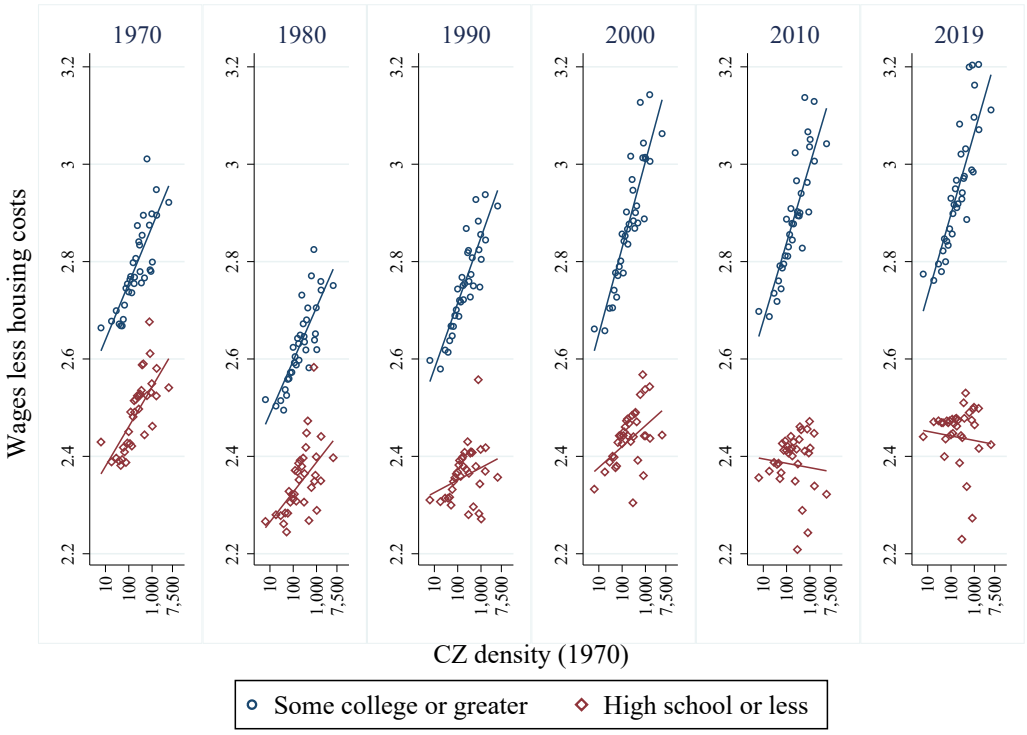

Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults that live in two bedroom housing units separately in each observation year: $WagesLessHousing_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $WagesLessHousing_i$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.5: Wages Less Housing Costs by Skill Group and Density Assuming All Workers Live in Two Bedroom Housing Units



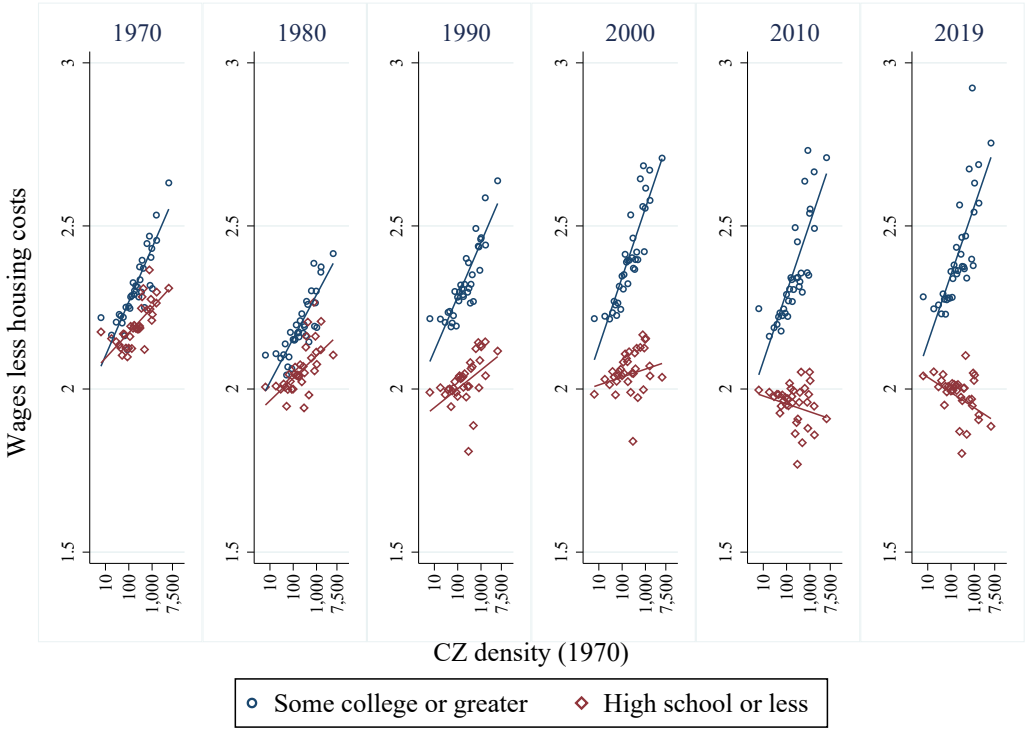

Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately in each observation year: $WagesLessHousing_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $WagesLessHousing_i$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. This individual measure of housing costs is then summarized for each commuting zone $i$ in each year $t$ and the median is applied to each observation to adjust for unit quality. This adjustments causes some observations to be dropped because housing costs exceed observed wages. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.6: Wages Less Housing Costs by Skill Group and Density for Workers that Own Their Housing Unit



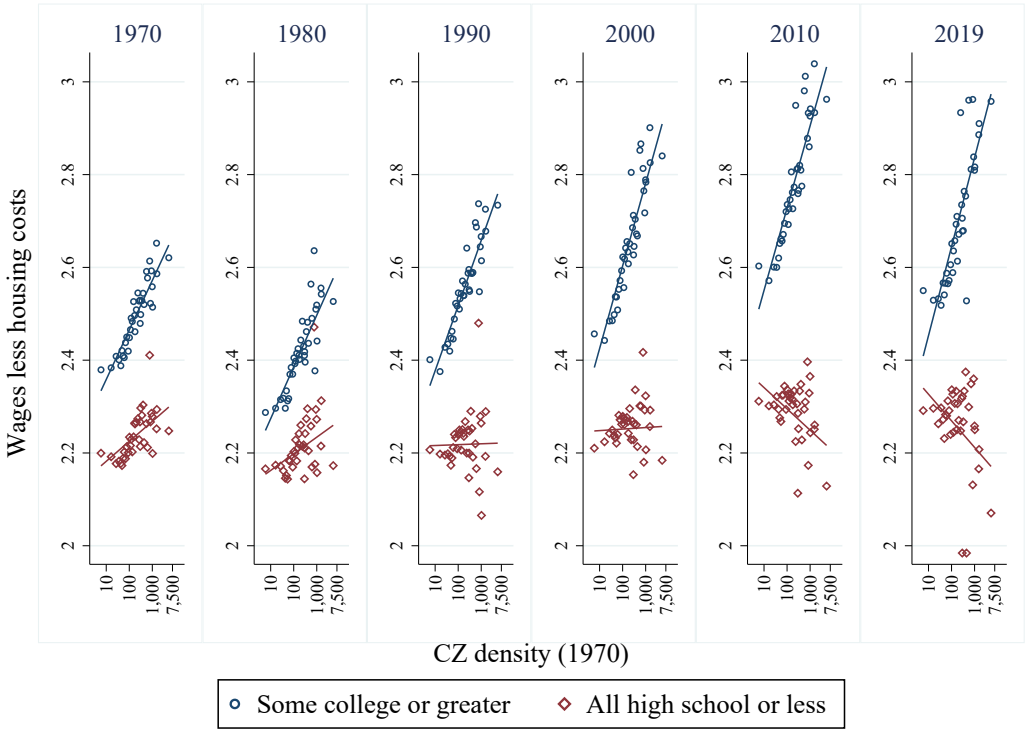

Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults that own their housing units separately in each observation year: $WagesLessHousing_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $WagesLessHousing_i$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.7: Wages Less Housing Costs by Skill Group and Density for Workers that Rent Their Housing Unit



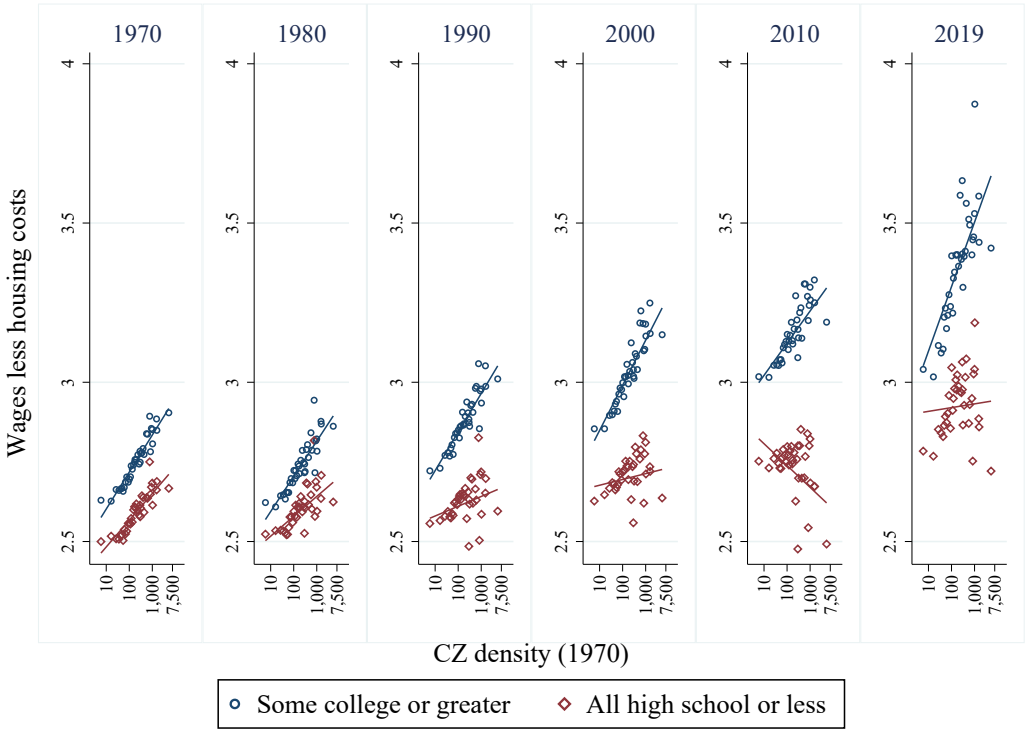

Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately that rent their housing units in each observation year: $WagesLessHousing_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $WagesLessHousing_i$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.8: Wages Less Housing Costs by Skill Group and Density for Single-Earner Households Only



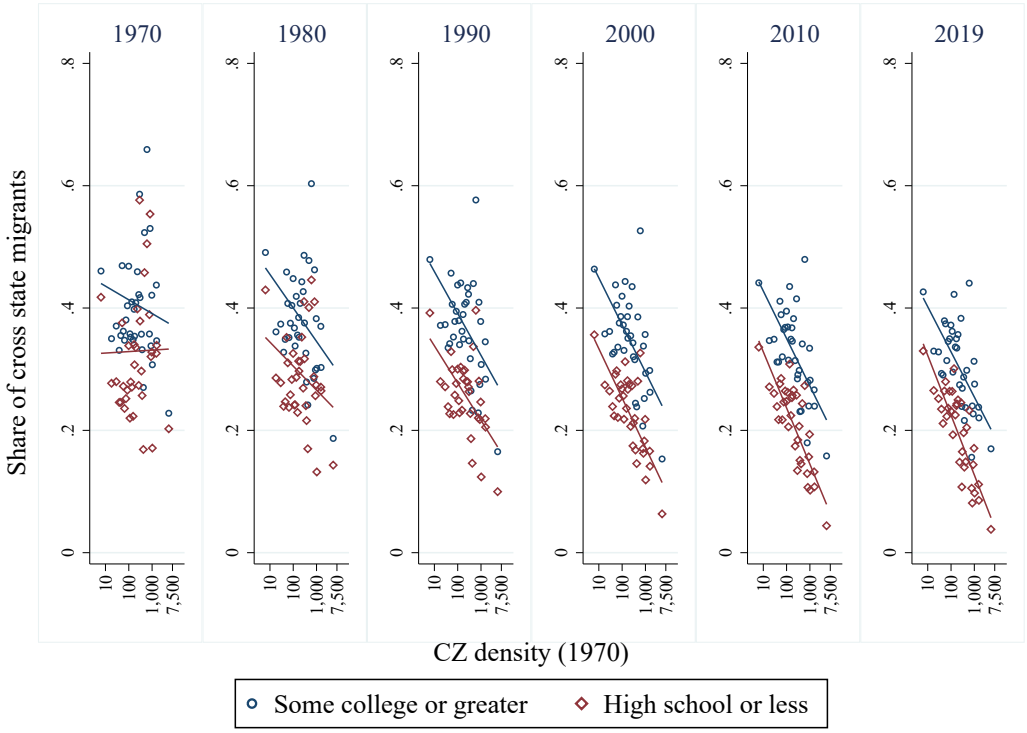

Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for households of college and non-college working-age adults with only one earner separately in each observation year: $WagesLessHousing_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $WagesLessHousing_i$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Wages are adjusted for household size by dividing by the square root of the number of household members. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.9: Wages Less Housing Costs by Skill Group and Density for Multi-Earner Households



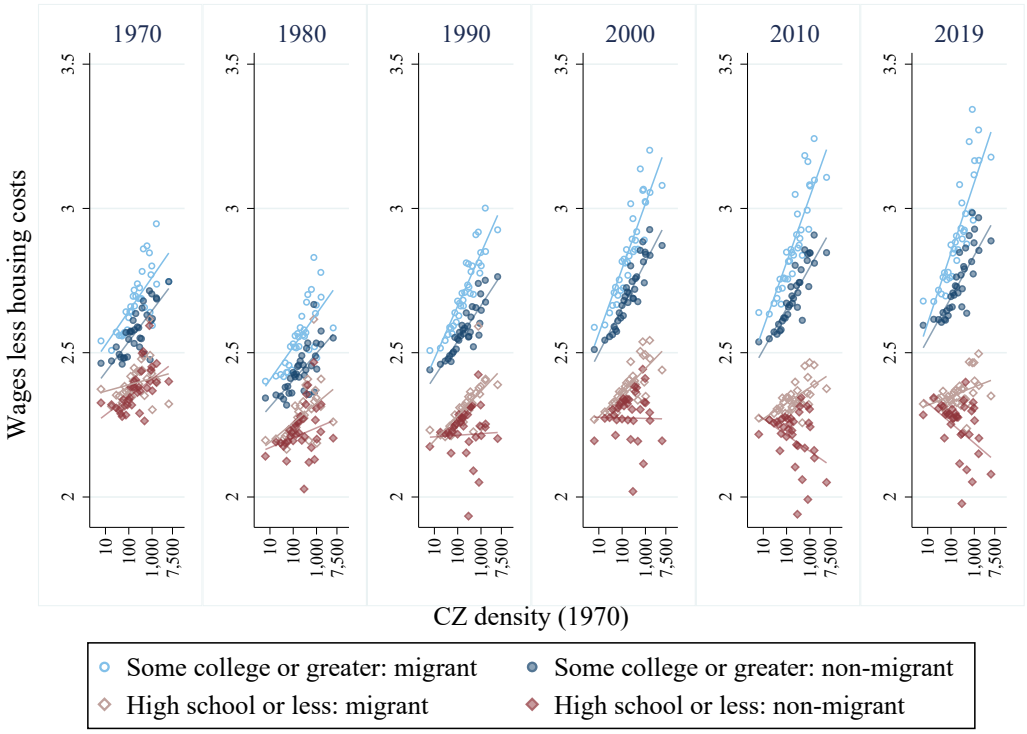

Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for households with multiple college and non-college working-age adults separately in each observation year: $WagesLessHousing_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $WagesLessHousing_i$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Wages are adjusted for household size by dividing by the square root of the number of household members. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.10: Native-Born Cross-State Migrants as Share of Skill Group by Density




Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately in each observation year: $CrossStateMig_i^{gt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $CrossStateMig_i^{gt}$ is the share of native-born cross-state migrants within group $g$ in commuting zone $i$. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Cross-state migrants are identified as individuals not residing in their state of birth. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. The sample includes only working aged adults from age 16 to 64 who make more than $112 per week in 2000 USD. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Figure A.11: Wages Less Housing Costs for Migrants and Non-Migrants by Skill Group and Density




Note: This figure uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college migrants, college non-migrants, non-college migrants, and non-college non-migrants working-age adults separately in each observation year: $WagesLessHousing_i^{mgt} = \alpha + \beta * ln(CZDensity1970)_i + \varepsilon_i$, where $WagesLessHousing_i$ is the average hourly wage less housing costs for migrant group $m$ of skill group $g$ in year $t$ for 1990 commuting zone $i$. Within each skill group the sample is split between native-born cross-state migrants and non-native-born cross-state migrants. The two skill groups are workers who have attended any years of college or greater and those who have only a high school degree or less. Hourly housing costs are the total annual housing costs for an individual calculated using 5 percent of home value or 12 times monthly rent as in Ganong and Shoag (2017) divided by 40 hours per week and 48 weeks worked. $CZDensity1970$ is the 1990 commuting zone density in 1970 for commuting zone $i$. County groups in 1970 and 1980 and PUMAs in 1990 and afterwards are mapped to 1990 commuting zones following a propensity matching procedure outlined in Dorn (2009) to create a 722 commuting zone panel. This regression is weighted by the working age population in each observation year.

Table A.1: Average Real Hourly Wages Less Housing Costs Across Skill Groups by Commuting Zone Density Over Time (2012 USD)

| **Panel A** | | | | **Some college or greater** | | | |
|---|---|---|---|---|---|---|---|
| Percentile | Pop per sqr. mile | 1970 | 1980 | 1990 | 2000 | 2010 | 2019 |
| $5^{th}$ | 22 | $12.26 | $10.89 | $12.17 | $13.42 | $13.57 | $13.97 |
| $10^{th}$ | 39 | $12.63 | $11.17 | $12.60 | $14.00 | $14.12 | $14.55 |
| $25^{th}$ | 79 | $13.09 | $11.51 | $13.13 | $14.74 | $14.80 | $15.28 |
| $50^{th}$ | 255 | $13.89 | $12.11 | $14.08 | $16.05 | $16.02 | $16.58 |
| $75^{th}$ | 623 | $14.53 | $12.58 | $14.84 | $17.12 | $17.00 | $17.64 |
| $90^{th}$ | 1,526 | $15.20 | $13.07 | $15.64 | $18.26 | $18.05 | $18.77 |
| $95^{th}$ | 1,572 | $15.23 | $13.09 | $15.67 | $18.30 | $18.09 | $18.81 |
| **Panel B** | | | | **High school or less** | | | |
| Percentile | Pop per sqr. mile | 1970 | 1980 | 1990 | 2000 | 2010 | 2019 |
| $5^{th}$ | 22 | $10.30 | $9.04 | $9.26 | $9.92 | $9.72 | $10.14 |
| $10^{th}$ | 39 | $10.44 | $9.14 | $9.30 | $9.93 | $9.60 | $9.98 |
| $25^{th}$ | 79 | $10.61 | $9.25 | $9.35 | $9.94 | $9.45 | $9.78 |
| $50^{th}$ | 255 | $10.89 | $9.45 | $9.43 | $9.96 | $9.20 | $9.46 |
| $75^{th}$ | 623 | $11.12 | $9.60 | $9.50 | $9.97 | $9.02 | $9.22 |
| $90^{th}$ | 1,526 | $11.35 | $9.75 | $9.56 | $9.99 | $8.84 | $8.99 |
| $95^{th}$ | 1,572 | $11.35 | $9.76 | $9.56 | $9.99 | $8.83 | $8.98 |

Note: This table uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately in each observation year:

$$WagesLessHousing_i^{gt} = \alpha + \beta * ln(CZDensity)_i + \varepsilon_i$$

where $WagesLessHousing_i^{gt}$ is the average hourly wage less housing costs for skill group $g$ in year $t$ for 1990 commuting zone $i$. Wages are annual total wages and salaries divided by 40 hours and 48 weeks worked to match Autor (2019). Housing costs are measured as 5 percent of home values or 12 times monthly rent following Ganong and Shoag (2017). Skill groups $g$ include college, which means individuals with any education above a high school degree, and non-college, which means individuals with high school or less. The difference between wage and salary income and housing costs is deflated by the US Bureau of Economic Analysis Personal Consumption Expenditures Chain Price Index and then the natural log is take for each individual and averaged at the commuting zone level. $CZDensity_i$ is the 1970 population per square mile for 1990 commuting zone $i$. $\varepsilon_i$ is an error term. **Panel A** shows wages lest housing cost estimates for workers who attended some college or greater. Estimates are presented by select commuting zone percentiles and observation years. **Panel B** shows the same estimates for workers who did not attend any college and therefore have only a high school degree or less. The sample includes only working aged adults from age 16 to 64 who make more than $112 per week in 2000 USD. Observations are matched with 1990 commuting zones following the matching procedure in Dorn (2009) to create a stable 722 commuting zone panel. Estimates reported in the table have had the natural log operator removed to give average estimates by commuting zone density in 2012 USD.

Table A.2: Commuting Zone Examples by Density

| Percentile | Pop per sqr. mile | Largest place in CZ |
|---|---|---|
| | 16 | Eureka, CA |
| | 20 | Nebraska City, NE |
| $5^{th}$ | 22 | Stuttgart, AR |
| | 27 | Fargo, ND |
| | 35 | Vicksburg, MS |
| $10^{th}$ | 39 | Tallahassee, FL |
| | 55 | Phoenix, AZ |
| | 65 | Burlington, VT |
| $25^{th}$ | 79 | Tulsa, OK |
| | 96 | Denver, CO |
| | 100 | San Antonio, TX |
| | 200 | Kansas City, MO |
| | 226 | San Jose, CA |
| $50^{th}$ | 255 | Houston, TX |
| | 273 | Atlanta, GA |
| | 293 | Dallas, TX |
| | 293 | Los Angeles, CA |
| | 302 | Toledo, OH |
| | 317 | San Diego, CA |
| | 428 | Pittsburgh, PA |
| | 596 | Washington, DC |
| $75^{th}$ | 623 | Bridgeport, CT |
| | 633 | Detroit, MI |
| | 821 | San Francisco, CA |
| | 863 | Providence, RI |
| | 907 | Cleveland, OH |
| | 916 | Baltimore, MD |
| | 992 | Philadelphia, PA |
| | 1,022 | Boston, MA |
| $90^{th}$ | 1,525 | Newark, NJ |
| $95^{th}$ | 1,572 | Chicago, IL |
| $99^{th}$ | 5,219 | New York, NY |

Note: This table shows the name of the (currently) largest place in select 1990 commuting zones. These commuting zones are ordered by their densities in 1970, measured by population per square mile, based on population figures from the 1970 US Census and commuting zone areas from Autor (2019). Percentiles are of the distribution of commuting zones, ordered by density, weighted by working-age population. Working-age adults are individuals aged 16-64. Observations are matched with 1990 commuting zones following the matching procedure in Dorn (2009) to create a stable 722 commuting zone panel.

Table A.3: The Relationship Between Growth in Native-Born Cross-State Migrants and Commuting Zone Average Wages and Housing Costs

| | **Average annual growth in number of native-born cross-state migrants** | | | | | |
|---|---|---|---|---|---|---|
| | Some college or greater | | | High school or less | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Ln CZ wages in $t-1$ | -0.035 | 0.040 | 0.045 | -0.029* | 0.033 | 0.032 |
| | (0.024) | (0.029) | (0.030) | (0.017) | (0.025) | (0.026) |
| Ln CZ housing costs in $t-1$ | | -0.043*** | -0.041*** | | -0.036*** | -0.036*** |
| | | (0.006) | (0.007) | | (0.007) | (0.006) |
| CZ share with any college in $t-1$ | | | -0.091*** | | | 0.030 |
| | | | (0.033) | | | (0.042) |
| CZ FEs | Y | Y | Y | Y | Y | Y |
| Year FEs | Y | Y | Y | Y | Y | Y |
| Constant | 0.154** | -0.021 | -0.028 | 0.084* | -0.062 | -0.060 |
| | (0.062) | (0.075) | (0.074) | (0.045) | (0.063) | (0.064) |
| Observations | 3,610 | 3,610 | 3,610 | 3,610 | 3,610 | 3,610 |
| $R^2$ | 0.731 | 0.743 | 0.748 | 0.633 | 0.644 | 0.645 |

Note: This table uses data from the 1970, 1980, 1990, and 2000 censuses and data from the 5-year pooled ACS for 2006-2010 and 2015-2019 to report estimates of regressions of the following form for college and non-college working-age adults separately over the periods 1970-1980, 1980-1990, 1990-2000, 2000-2010, and 2010-2019:

$$GrCrossStateMig^{g}_{i,t,t-1} = \alpha + \beta * ln(Productivity)_{i,t-1} + \delta * ln(HousingCosts)_{i,t-1} + \pi * (CollegeShare)_{i,t-1} + \tau_{t-1} + \kappa_i + \varepsilon_{i,t}$$

where $GrCrossStateMig^{g}_{i,t,t-1}$ is the average annual growth rate in the number of native-born cross-state migrants of skill group $g$ between years $t-1$ and $t$ for 1990 commuting zone $i$. Skill groups $g$ include college, which means individuals with any education above a high school degree, and non-college, which means individuals with a high school degree or less. $Productivity_{i,t-1}$ is the overall wages for all working aged people in commuting zone $i$ for each observation period in year $t-1$. Wages are annual total wages and salaries divided by 40 hours and 48 weeks worked to match Autor (2019). $HousingCosts_{i,t-1}$ is the overall housing costs for all working aged people in commuting zone $i$ for each observation period in year $t-1$. Housing costs are measured as 5 percent of home values or 12 times monthly rent following Ganong and Shoag (2017) and divided by 40 hours and 48 weeks to be hourly. Wage and salary income and housing costs are deflated by the US Bureau of Economic Analysis Personal Consumption Expenditures Chain Price Index. $CollegeShare_{i,t-1}$ is the fraction of individuals in a commuting zone with some college or greater. $\tau_{t-1}$ and $\kappa_i$ are year and commuting zone fixed effects, respectively, and $\varepsilon_i$ is an error term. **Columns 1, 2, and 3** present results for college workers and **Columns 4, 5, and 6** present results for non-college workers. The sample includes only working aged adults from age 16 to 64 who make more than $112 per week in 2000 USD. Observations are matched with 1990 commuting zones following the matching procedure in Dorn (2009) to create a stable 722 commuting zone panel. Robust standard errors are in parentheses.

*$p < .1$, ** $p < .05$, *** $p < .01$