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Black and Latinx workers reap lower rewards than White workers from years spent working in big cities

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The large labor markets of big cities offer greater possibilities for workers to gain skills and experience through successively better employment opportunities. This "experience effect" contributes to the higher average wages that are found in big cities compared to the economy as a whole. Racial wage inequality is also higher in bigger cities than in the economy on average. We offer an explanation for this pattern, demonstrating that there is substantial racial inequality in the economic returns to work experience acquired in big cities. Using data from the National Longitudinal Survey of Youth, 1979 we find that each year of work experience in a big city increases Black and Latinx workers' wages by about one quarter to half as much as White workers' wages. A substantial amount of this inequality can be explained by further racial disparities in the benefits of high-skill work experience. This research identifies a heretofore unknown source of inequality that is distinctly urban in nature, and expands our knowledge of the challenges to reaching interracial wage equality.

racial inequality | urban wage premium | agglomeration | geography | cost-of-living

Significance

Bigger cities are widely agreed to generally provide greater career-long learning opportunities for workers than smaller cities. However, recent research also shows that racial inequality in wages tends to be higher in larger cities. In this research, we show that this greater disparity in bigger cities builds over time, as White workers are rewarded more than Black and Latinx workers for the experience acquisition advantages that big cities provide. This is true even when such workers have similar starting skills and enter the same occupations. Our results thus suggest that reducing racial economic inequality in big cities may require both equalizing initial access to education and highly rewarded occupations as well as rewarding career-long work experience equally.

Workers in big cities (henceforth more precisely referred to as "large urban areas," defined as integrated commuting regions) have higher average wages than in smaller cities or rural areas. Part of this can be explained by the fact that the largest urban and highest-income areas, often dubbed "Superstar" city-regions, have a higher share of college-educated workers than their respective national economies (1–4). But in addition, college-educated workers in particular are paid more in large urban areas than they are in smaller ones, giving them a substantial "urban wage premium."

Researchers agree that such urban wage premiums exist not only because the composition of the workforce is different in large urban areas as compared to smaller ones, but also because similarly educated workers have higher incomes when they are in large, dense urban areas. Thus, there is something about increasing city size that enables workers to be more productive. Larger urban areas make workers more productive by better matching workers' specific skills and aptitudes to the right task or firm, as there is a larger and more diverse set of employers and activities with which to match (5). In addition, workers in large urban areas acquire more valuable experience across their careers, progressing through more jobs, learning new skills as they go along, and then bringing these additional skills to successive jobs. This phenomenon is known as "experience" or "dynamic" effects (2).

The *Top* plot of Fig. 1 highlights these wage and salary income benefits of large urban areas in 1990 (near the beginning of our study period) and in 2017 (at the end). The *Top* plots in the figure show a strong positive relationship between the size of an urban region ["ln(Population)"] and the average hourly wage and salary income for workers, a relationship that has slightly increased in magnitude over time. Yet, these benefits appear to accrue much more strongly to White workers than their Black and Latinx counterparts (6, 7).* This is evident in the *Bottom* panels of Fig. 1. White workers have a much stronger urban wage premium than for the average of all workers (i.e. a steeper slope). In contrast, Black and Latinx workers' wages are both lower in absolute terms across all places when compared to White workers, and are more weakly related to city-size. In addition, this disparity has grown over time, primarily driven by an increase in the urban wage premium for White workers. Most observers attribute the growth in urban wage premiums to the increasing concentration over time of the highest-wage sectors in bigger urban areas (8). In this light, it appears that White workers have captured more of this increasing urban

*In this paper, we capitalize both White and Black to emphasize each is a socially constructed category rather than simply a descriptive characteristic. We also use the term Latinx rather than Latino/a/e given the use of the term among scholars in our home discipline (who themselves identify as Latinx), as the term is more gender inclusive, as well as because our analysis does not differentiate workers by gender. Finally, we use "race" as a shorthand for race/ethnicity throughout the paper as the NLSY data that we use does not differentiate between races within the Hispanic (Latinx) category.

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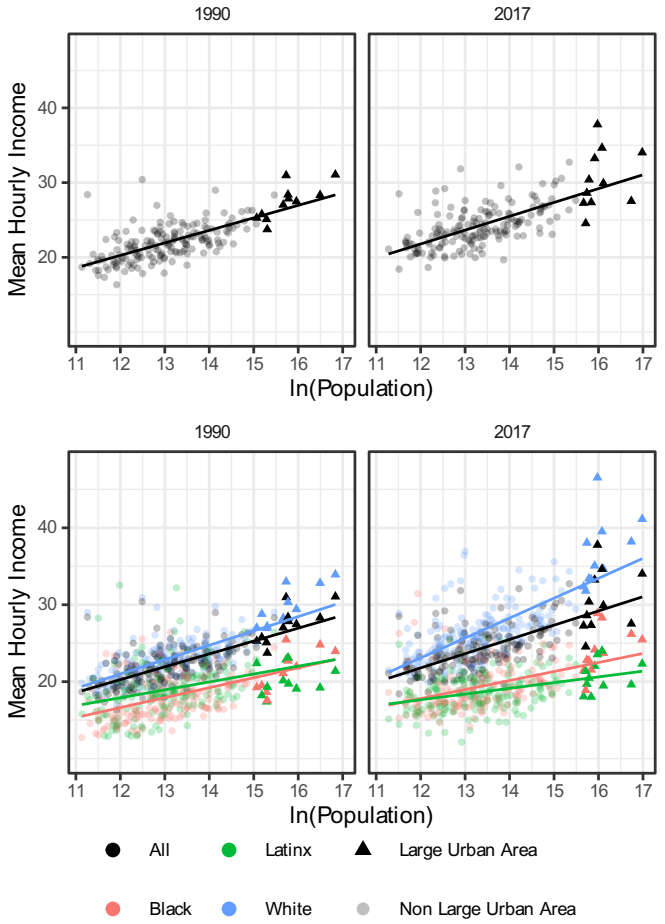

Fig. 1. The *Top* plots show the urban wage premium for all workers in 1990 and 2017. The *Bottom* plots show the urban wage premium separately for all, Black, Latinx, and White workers in both years. Data come from 1990 Decennial Census and 5-y 2017 American Community Survey (ACS) summary and microdata (10, 11). The sample includes workers between 25 and 65 y of age who were employed at the time of the survey and reported working at least 48 wk, for 30 h a week, and who had (inflation adjusted) wage and salary incomes over $1,000, in the previous year. Hourly income is measured as annual income from wages and salaries divided by the number of hours the respondent reported normally working in a week multiplied by 52. Respondents were assigned to labor markets by using a similar weighting method to refs. 12 and 13 where respondents' census weights are multiplied by the share of their Public-Use Microdata Area (the smallest unit respondents can be matched to in ACS and Decennial Census microdata) that is within a given one of our 275 spatial labor markets (though we only show results for the 179 labor markets that had at least 20 Black, Latinx, and White respondents in each year), as defined in *Materials and Methods*.

advantage and consequently, there is substantially more Black–White and Latinx–White wage inequality within larger urban labor markets than is found in smaller ones, an inequality that has increased over time. These disparities remain after controlling for a wide range of demographic characteristics (6, 7, 9).[†]

In the next section, we show that there is racial inequality in the benefits of working in a large urban area due to racial differences in rewards to experience. For White workers, our main estimates are that each additional year of work experience in a "large" urban area (defined as U.S. urban areas which have >6 million people, labeled with triangles in Fig. 1) increases wages by 42 cents per hour more than each additional year of experience in a non-large urban area. By contrast, each year of additional work experience in a large urban area elevates Black and Latinx workers' wages by only about 21 and 10 cents an hour, respectively. These results highlight how racial inequalities in wages in large urban regions compound over workers' lifetimes to become very large over a whole career.

Results

Estimating Rewards to Large Urban Area Work Experience by Race. Table 1 reports our main regression estimates. To generate the results, we analyze panel data from the National Longitudinal Survey of Youth 1979 (NLSY79) cohort. This survey follows an initial sample of 12,686 individuals from 1979 until the present, of which 7,341 are in our final sample (2,214 Black, 1,470 Latinx, and 3,657 White), corresponding to 57,897 person-years. Respondents were between the ages of 14 and 22 when the survey began in 1979. They were interviewed every year from 1979 to 1994, and biannually thereafter. We focus on the years 1994 to 2018 (with income reported from the previous calendar year, thus 1993 to 2017) when respondents were in their prime working years. Using the restricted access geocode files of the survey, we were able to match workers to either one of the large labor markets from Fig. 1, or a non-large urban area, in each round of the survey. This allowed us to calculate their years of overall work experience (*All Experience*), and their years of *Large Urban Area Experience* as of each survey round. We then regressed their hourly incomes from wages and salaries (*Hourly Income*—our dependent variable) on their years of overall and large urban area work experience, as well as worker, year, and labor market fixed effects. When using panel data, a fixed effects approach is called for in order to control for characteristics of workers that do not change over time (including unobservable characteristics such as ability or effort, as well as observable characteristics such as education or sex), thus reducing potential omitted variable bias. Our fixed effects models also control for economy-wide shocks to wages in specific years, as well as workers' different propensities to move into higher wage labor markets. Additionally, each model includes a coefficient for *In Large Urban Area*. Whereas *Large Urban Area Experience* identifies the increasing benefits of spending more time working in a big urban region, *In Large Urban Area* identifies the one time benefit of moving to a large city-region.[‡] This captures the fact that the wage benefits of being located in a large urban area may, in some cases, be experienced statically at one point in time, rather than increasing over the worker's career. Interested readers can refer to *SI Appendix* for descriptive statistics, including a graph of the bivariate relationships between experience and wages that closely reflects our findings in Table 1.

Before describing the results, we note that studies of urban wage premiums have attempted to capture the idea that they might be related to large urban areas overall or to larger concentrations of a certain type of activity (agglomeration economies). In turn, some operationalize size as population and others as the density of urban areas. There is no consensus on which is more important (16). We chose to focus on overall size rather than density because we believe the former corresponds to a more economically comparable set of urban areas. For example, density can be quite high in small metros, and can take very different spatial forms in large ones (e.g. New York and Los Angeles have

[†]These inequalities also hold up regardless of whether we log wages, population, or both.

[‡]Because we use person fixed effects, the coefficient for *In Large Urban Area* is identified only from respondents who moved in or out of a large urban area. In our sample, this corresponds to 328, 235, and 197 White, Black, and Latinx respondents respectively. This is a large enough sample to make us reasonably confident that we are able to get a good estimate of the one-time benefit of moving to a big urban region, and how this varies across race.

Table 1. Racial disparities in the benefits of working in large urban areas

	Base model	Base model with race interactions	Occupation sorting disparities	Occupation remuneration disparities	Job mobility disparities	Job mobility remuneration disparities	High skill experience disparities
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All Experience	1.268***	1.302***	1.288***	1.293***	1.220***	1.244***	0.781***
	(0.072)	(0.074)	(0.074)	(0.074)	(0.078)	(0.079)	(0.069)
Large Urban Area Experience	0.233***	0.421***	0.426***	0.427***	0.416***	0.433***	0.313***
	(0.040)	(0.077)	(0.076)	(0.076)	(0.078)	(0.081)	(0.071)
High-Skill Experience							0.883***
							(0.059)
All Experience*Black		−0.266***	−0.265***	−0.267***	−0.261***	−0.292***	0.005
		(0.036)	(0.036)	(0.035)	(0.036)	(0.044)	(0.036)
All Experience*Latinx		−0.107**	−0.105**	−0.109**	−0.102**	−0.147***	0.089**
		(0.045)	(0.045)	(0.045)	(0.045)	(0.055)	(0.044)
Large Urban Area Experience*Black		−0.215**	−0.218**	−0.219**	−0.217**	−0.273***	−0.126
		(0.087)	(0.087)	(0.087)	(0.087)	(0.092)	(0.081)
Large Urban Area Experience*Latinx		−0.324***	−0.327***	−0.328***	−0.330***	−0.324***	−0.224**
		(0.104)	(0.104)	(0.104)	(0.104)	(0.111)	(0.099)
High Skill Experience*Black							−0.424***
							(0.083)
High Skill Experience*Latinx							−0.273**
							(0.106)
In Large Urban Area	1.101	1.819	1.535	1.618	1.200	2.577	0.461
	(4.147)	(4.360)	(4.428)	(4.467)	(4.329)	(4.608)	(4.369)
In Large Urban Area*Black		−0.450	−0.435	−1.060	−0.396	−4.828	−0.155
		(1.922)	(1.930)	(2.180)	(1.922)	(3.397)	(1.845)
In Large Urban Area*Latinx		−1.914	−1.898	−1.791	−1.845	−1.875	−1.933
		(1.771)	(1.767)	(2.019)	(1.772)	(3.621)	(1.699)
Occupation*In Large Urban Area Controls	No	No	Yes	Yes	No	No	No
Occupation*In Large Urban Area*Race Controls	No	No	No	Yes	No	No	No
New Jobs*In Large Urban Area Controls	No	No	No	No	Yes	Yes	No
New Jobs*In Large Urban Area*Race Controls	No	No	No	No	No	Yes	No
R^2	0.031	0.037	0.038	0.038	0.038	0.038	0.064

Notes: N = 57,897, with 7,341 unique individuals. Heteroskedasticity and autocorrelation consistent SEs are reported in parentheses. Dependent variable = hourly income from wages and salaries. All regressions include worker, year, and labor market fixed effects. Work experience is measured as the number of weeks a respondent reported working at least 30 h up to the year before income is measured and then divided by 52 to reflect years. *Large Urban Area Experience* is work experience accumulated in an urban area > 6 million people. We use the "high," "mid," and "low" skill occupation categories from refs. 14 and 15.

*$P < 0.1$; **$P < 0.05$; ***$P < 0.01$.

similar metro area density levels, but New York's density is much more peaked, whereas Los Angeles's is more spread out). This explains why for instance, there are agglomerations of firms that are very walkable in Manhattan (e.g. advertising) and others that are more spread out (e.g. Silicon Valley). The two are very correlated in our sample of labor markets (a correlation of 0.71) so we do not believe this has a major impact on our results. However, we also consider density as a channel through which the overall size of labor markets might generate inequality in Table 2.

Column 1 of Table 1 reports results from our base model, which estimates the value of *Large Urban Area Experience* for all workers pooled together. More specifically, we estimate the value of an additional year of *Large Urban Area Experience* relative to an additional year of experience accumulated outside a large urban area, conditional on *All Experience*, *In Large Urban Area*, and fixed effects. The coefficient suggests that each additional year of *Large Urban Area Experience* is worth about 23 cents an hour more than experience outside a large urban area, for all workers on average. The coefficient for *In Large Urban Area* by contrast is relatively small (implying about a $1.10 one-time benefit of being located in a big urban region) and insignificant. This finding is in line with other research (2, 17) which shows that the urban wage premium is due in large part to the dynamic benefits of building a career in a large city-region.

Column 2 reports our main result. Rather than pooling all workers together, we now let the benefits of *All Experience* and *Large Urban Area Experience* vary by race. The main effects for *All Experience* and *Large Urban Area Experience* thus estimate the relationship between these variables and income for White workers, while the interactions show how these associations are different for Black and Latinx workers. For White workers, the coefficient for *Large Urban Area Experience* is nearly twice as large as it is for workers overall, increasing from 0.233 to 0.421, or 42 cents an hour. By contrast, for Black and Latinx workers, the results imply that each additional year of experience in a big city-region increases their wages by about 21 ($0.421 - 0.215 = 0.206$) and 10 ($0.421 - 0.324 = 0.097$) cents

Table 2. Mechanism exploration: Endogenous features of urban scale

	Experience in urban areas with the 10 next highest					
	Population (1)	Black isolation (2)	Latinx isolation (3)	Density (4)	Rents (5)	Commutes (6)
All Experience	1.296***	1.313***	1.302***	1.309***	1.288***	1.301***
	(0.074)	(0.075)	(0.074)	(0.075)	(0.074)	(0.074)
Large Urban Area Experience	0.429***	0.412***	0.421***	0.415***	0.437***	0.421***
	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)
Work Experience in [See column header]	0.042	−0.126	0.037	−0.043	0.365**	−0.00001
	(0.082)	(0.097)	(0.179)	(0.085)	(0.159)	(0.106)
All Experience*Black	−0.247***	−0.278***	−0.265***	−0.260***	−0.246***	−0.257***
	(0.038)	(0.038)	(0.036)	(0.038)	(0.036)	(0.037)
All Experience*Latinx	−0.054	−0.118**	−0.088	−0.080	−0.067	−0.086*
	(0.051)	(0.046)	(0.054)	(0.049)	(0.047)	(0.049)
Large Urban Area Experience*Black	−0.234***	−0.201**	−0.215**	−0.220**	−0.234***	−0.223**
	(0.088)	(0.089)	(0.087)	(0.088)	(0.087)	(0.088)
Large Urban Area Experience*Latinx	−0.376***	−0.313***	−0.343***	−0.351***	−0.365***	−0.345***
	(0.107)	(0.104)	(0.108)	(0.106)	(0.105)	(0.105)
Work Experience in [See column header]*Black	−0.128	0.151	−0.084	−0.052	−0.527**	−0.099
	(0.104)	(0.118)	(0.217)	(0.109)	(0.232)	(0.132)
Work Experience in [See column header]*Latinx	−0.290**	0.621	−0.100	−0.236*	−0.662***	−0.151
	(0.115)	(0.383)	(0.192)	(0.129)	(0.203)	(0.142)
In Large Urban Area	2.002	1.756	1.863	2.015	1.792	2.016
	(4.346)	(4.358)	(4.355)	(4.362)	(4.355)	(4.363)
Currently in [See column header]	−2.943	−9.773*	−0.947	14.071***	15.408***	14.244***
	(4.067)	(5.310)	(5.259)	(4.610)	(4.523)	(4.626)
In Large Urban Area*Black	−0.394	−0.279	−0.467	−0.496	−0.391	−0.708
	(1.950)	(1.918)	(1.935)	(1.963)	(1.945)	(1.962)
In Large Urban Area*Latinx	−2.463	−1.873	−1.992	−2.256	−2.136	−2.174
	(1.832)	(1.780)	(1.791)	(1.853)	(1.798)	(1.813)
Currently in [See column header]*Black	0.453	2.633	−0.977	−0.512	0.591	−2.167
	(2.207)	(2.522)	(4.106)	(2.323)	(3.296)	(2.406)
Currently in [See column header]*Latinx	−2.430	2.907	−2.127	−1.995	−3.504	−1.336
	(1.925)	(5.099)	(3.553)	(2.389)	(3.245)	(2.266)
R2	0.038	0.037	0.037	0.038	0.038	0.037

N = 57,897, with 7,341 unique individuals. Heteroskedasticity and autocorrelation consistent SEs are reported in parentheses. Dependent variable = hourly income from wages and salaries. All regressions include worker, year, and labor market fixed effects. Work experience is measured as the number of weeks a respondent reported working at least 30 h up to the year before income is measured and then divided by 52 to reflect years. *Large Urban Area Experience* is work experience accumulated in an urban area > 6 million people. Each column (in addition to *All Experience* and *Large Urban Area Experience*) includes experience in the 10 labor markets (excluding our large urban areas) with the highest values of whatever variable is in the column header.

*$P < 0.1$; **$P < 0.05$; ***$P < 0.01$.

an hour respectively. Stated differently, each year of experience in a large urban area is worth only about 49 (0.206/0.421 = 0.489) and 23 (0.097/0.421 = 0.230) percent as much for Black and Latinx workers as it is for White workers. In addition, the coefficients for *All Experience*Black* and *All Experience*Latinx* are also negative, implying that non-White workers get weaker returns to *All Experience* as well.[§]

Despite large racial disparities in the dynamic benefits of working in a big urban region, the *In Large Urban Area* main and interaction coefficients are all relatively small, and statistically insignificant. This further supports our key finding that racialized inequality in the benefits of accumulating experience in a large urban area contributes to the ways in which urban scale is related to racial wage inequality as a whole and that the experience-reward gap unfolds over the span of workers' lives.

Implicit in the results in column 2 are race-specific equations for the value of years spent working in large urban areas. These correspond to a one time static benefit from *In Large Urban Area* (the intercept) and a dynamic benefit from *Large Urban Area Experience* (the slope). We graph these equations in Fig. 2. While the intercepts reflect small initial disparities in the value of working in a big urban region, the differences become very large over time. At the end of a 30 y career for instance, the average White person in a large urban area makes about $14 more an hour than the average White person outside a large urban area. This figure is only about $8 and $3 for Black and Latinx workers respectively. When accumulated over decades, disparities in rewards to *Large Urban Area Experience* thus can generate tens of thousands of dollars in annual wage inequality.

Race is deeply intertwined with class (18) and shapes nearly every facet of our economic lives, from how much education we are able to acquire to providing access or encouragement to sort into certain occupations in the labor market. We attempt to disentangle some of these channels and feedbacks by testing five possibilities. These can be seen in columns 3 to 7 of Table 1.

[§]While not the focus of this paper, we have not seen this finding documented elsewhere, and it could mean that such experience-based inequality has economy- or society-wide causes. Our specific focus is on the role of large urban regions in this, because—as we noted in the introduction—it is in these city-regions where, on average, workers appear to be able to access the greatest spatial premiums to wages and work experience in recent decades.

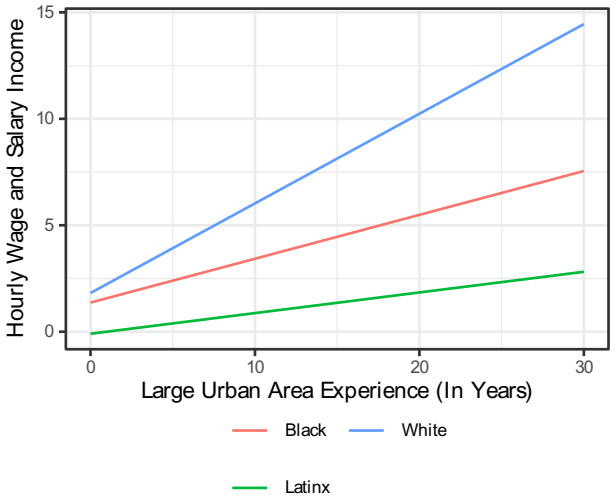

Fig. 2. The graph above plots race-specific slopes and intercepts for the returns to working in a large urban area, implied by the results in column 2 of Table 1.

First, we consider whether the disparities in the benefits of work experience in large urban regions disappear when we account for the propensities of workers of different races to work in different occupations. The bottom plots in Fig. 1 show that the urban wage premium is largely driven by differences in the wages of White people, while there is very little variation in Black and Latinx workers' wages between big and small urban areas. The same is true for occupations. Other research shows that the urban wage premium is largely driven by workers in a select set of "high skill" occupations (14). The stronger returns to work experience in large urban areas for White workers might thus be due to their disproportionate likelihood of working in high skill occupations, regardless of actual skills and qualifications (19). We control for this, by classifying workers into high-, mid-, and low-skill occupations following refs. 12–15. These occupational categories are generated by classifying occupations based on whether they primarily involve tasks that require abstract reasoning ("high skill"), are easily codifiable and routine ("mid skill"), or are manually intensive ("low skill").[¶] We also interact occupations with whether workers are currently in a large urban area, since there are substantial differences in occupation-specific remuneration across big and small urban regions (i.e. the urban wage premium again). As shown in column 3, there is no great difference from the base model in column 2.

Second, and closely related to the above, we consider that the disparities in the returns to large urban area experience may not solely be driven by disparities in workers' propensities to work in certain occupations, but instead, by racial disparities in remuneration once these workers sort into occupations. For example, it might be the case that upon sorting into a high skill occupation in a big urban region, Black and Latinx workers' initial wage offers are simply much lower than those of White workers. Column 4 shows this effect to not change our main results in column 2.

Third and fourth, we look at a key possible channel of acquiring experience, which is job mobility or turnover. In the standard "matching" model of agglomeration of workers and employers, the spatial concentration of high skill urban industries enables firms to practice high levels of turnover as they rapidly hire and layoff workers. This is because they can quickly access workers when they need them, due to the high spatial concentration of specialized workers, who in turn concentrate together to facilitate more successful job search through access to many possible specialized employers as they are laid off relatively frequently (5, 20). Workers' faster wage growth in larger urban regions is thus partially attributable to job changes, rather than within-job wage growth, as workers capitalize previous experience into higher wages in successive jobs (21). Thus, in examining differences in the returns to experience, we must know whether there are differences in job mobility by race. Black and Latinx workers might, for instance, switch jobs more frequently than White workers because of discrimination, or less frequently because of anticipated discrimination.

We sum the total number of jobs each respondent has had as of each year. We call this variable *New Jobs* as our inclusion of worker fixed effects means we capture how many new jobs a respondent has had since their last interview. As with occupations, we interact *New Jobs* with *In Large Urban Area* as there may be big/small urban region differences in remuneration for job mobility. We also test a *New Jobs*In Large Urban Area*Race* interaction, as there may be racial differences in remuneration for job mobility that drive disparities in the value of *Large Urban Area Experience*. The results are reported in columns 5 and 6 of Table 1. Once again, they do not alter the base results significantly; indeed, they increase modestly in magnitude and significance.

These tests for possible reasons for the observed disparities in the returns to *Large Urban Area Experience* in columns 3 to 6 do not change the basic results. Stated differently, accounting for differences in occupational sorting/job mobility, as well as race-specific returns to working in certain occupations and for job mobility, does not explain why Black and Latinx workers benefit less from working in a large urban area. This result does not mean that there are necessarily no differences in occupational sorting/job mobility, nor race-specific differences in occupation-specific remuneration therein, but rather, that these differences cannot explain inequality in the value of *Large Urban Area Experience*.

Finally, we consider whether unequal returns to years spent working in a large urban region are driven by disparities in the value of accumulating experience in high skill occupations (column 7). A unique feature of these occupations is that their high degree of abstract task content tends to be less easily codifiable by explicit work rules than many routine (mid skill) or manual (low skill) occupations. When tasks are more codifiable, performance can be measured more objectively (though of course, discrimination may still occur). This makes evaluating the performance of high skill work more subjective, and this subjectivity could therefore allow more avenues for racial discrimination in evaluation and wage-setting.

Incorporating high skill experience provides some additional insight into the conclusions that can be drawn from the base model in column 2. Before continuing, it is worth noting that, as with *All Experience* and *Large Urban Area Experience*, Black and Latinx workers receive lower returns to *High Skill Experience* than White workers. This is especially true for Black workers, whose hourly wages increase by about 42 cents an hour less than White workers for each additional year of experience in a high skill occupation.

As noted previously, the urban wage premium is primarily driven by the much stronger returns workers enjoy from working in high skill occupations in bigger city-regions. However, as with

[¶] Classifying occupations in this way may of course miss a substantial degree of heterogeneity within occupations and there is always the potential to misclassify occupations altogether. Skill may also not be best represented in a continuous way like this, and we do not wish to make a normative statement on the value of work or workers in different occupations. Still, we believe it is helpful to shed light on differences across occupations as there are clearly different material rewards that exist across these classifications, rewards which in turn vary by city-size.

the urban wage premium overall, this could result from static effects (i.e. higher initial wage offers for high-skill occupations in large urban areas) or dynamic effects (i.e. greater increases in high-skill wages over time in larger urban areas). Thus, racial disparities in the value of *Large Urban Area Experience* might be driven largely by disparities in the value of *High Skill Experience*. Here, the effect is important. The inclusion of *High Skill Experience* substantially decreases the disparities in *Large Urban Area Experience*. The coefficients decrease from −0.215 and −0.324 in column 2 to −0.126 and −0.224 in column 7 for Black–White and Latinx–White inequality respectively, with the former no longer being statistically significant. Yet, even after accounting for differences in the benefits of *High Skill Experience*, the *Large Urban Area Experience*Latinx* coefficient is still negative and significant at the 5 percent level. This suggests that at least when it comes to Latinx–White inequality, there is something about big urban areas, above and beyond systematic differences in sorting into and accumulating experience in high skill occupations, that generates further inequality across workers' careers.

A counterfactual scenario in which there were no differences in the benefits of *High Skill Experience* would also substantially change the interaction between *All Experience* and race. For Black workers, there would no longer be a statistically significant difference compared to White workers, while for Latinx workers there would be a slightly larger return to *All Experience* than for White workers (i.e. the interaction coefficient is positive). In other words, if not for their much weaker returns to *Large Urban Area Experience* and *High Skill Experience*, there would not be any racial disparities in the increase in wage and salary income that occurs over time as individuals accumulate work experience.[#]

The Specific Role of Urban Size. We now ask exactly what it is about large urban areas that generates the disparities we observe in Table 1. Several interrelated features of urban areas have effects on the economy that grow with increasing population or spatial scale. Some of these could potentially create channels that increase inequality in their labor markets. As a simple test of this, in Table 2, we consider how experience premiums vary across race in the labor markets (excluding our "large urban areas") with the 10 next largest values of different urban characteristics that are closely related to size. More specifically, we consider segregation using Black and Latinx isolation indices,[‖] population density, average rental prices, and average commute times. We experimented with different ways of measuring all of them, which yielded similar results.

Before doing this, we first establish a baseline in column 1 by looking at returns to experience in the 10 next largest urban areas. This serves two purposes. First, this exercise sheds light on whether any of the relationships we observe with the other urban characteristics simply reflect the size of a city-region rather than the dimensions of labor markets that are found in the column headers. Second, it acts as a robustness check for our decision to identify "large" urban areas as those with populations >6 million. Our choice to use this cutoff was in large part motivated by the fact that the >6 million category is a relatively homogeneous group in the sense that all have been growing in recent decades, have in recent decades captured many of the most dynamic high-wage activities of the contemporary economy, and are generally characterized by college-educated in-migration and non-college-educated outmigration. By contrast, just below 6 million there are declining Rustbelt urban areas as well as "middle income" rapidly growing Sunbelt urban areas that have an occupational-educational-wage mix quite different from the bigger metros.

The coefficients for experience in the 10 next largest urban areas are generally insignificant with the exception of Latinx workers, whose negative coefficient implies not only weaker returns to experience in the 10 next biggest city-regions than White workers, but also worse returns to experience in those urban areas than in all other urban areas (given that 0.042–0.290 is negative). This finding implies that any racial differences we observe (particularly for White and Black workers) in columns 2 to 6 likely reflect labor market disparities induced by the characteristics in the column header, rather than through their relationships with population. Moreover, it also suggests that our cutoff at 6 million for large urban areas is appropriate, as it is only in these urban regions where population-size experience premiums are evident.[**]

For segregation (columns 2 and 3) the results do not yield any statistically significant racial disparities, suggesting that this is not a channel through which urban scale creates uneven returns to experience.

We do not find significant racial disparities in the value of experience in dense and high commuting time urban areas either (with the exception that the coefficient for Latinx workers' experience in dense city-regions is negative and significant at the 10 percent level). However, Table 2 does yield another interesting result for dense and high commute urban areas. In both cases, the coefficient for whether a White worker is currently in a dense or high commute labor market is relatively large, positive, and statistically significant. The same is true for expensive city-regions, and in all three cases, there are no statistically significant differences for non-White workers. These large static benefits are very different from what we observe in large urban areas, where the wage benefits are largely dynamic.

Our main finding in Table 2 is that there are also significant racial disparities in the benefits of working in expensive urban areas, larger in fact than the disparities for large urban areas. Once again, these disparities increase over workers' careers. White workers are paid about 37 cents an hour more for each year they spend in an expensive urban area, relative to an urban area that is not large or expensive. By contrast, the coefficients for Black and Latinx workers imply that each year of experience in an expensive urban area is worth 16 and 30 cents less than experience in urban regions that are not big or expensive (that is, even though they do appear to get a large static premium, Black and Latinx workers experience weaker experience effects in expensive urban areas than in urban areas which are not big or expensive). This large disparity is remarkable, and suggests that the size and cost-of-living in urban regions interact to favor White workers in leveraging skills and experience.

Finally, we note that our dependent variable *Hourly Income* is specified in levels (i.e. its natural scale) rather than in logs.

[#]We also carried out several robustness checks of the results in columns 3 to 6. We experimented with a more disaggregated occupational categorization using 12 rather than 3 occupational categories, but the results did not appreciably change. Likewise, we experimented with the inclusion of a quadratic term for New Jobs as well as with including a 4-way New Jobs*Occupation*In Large Urban Area*Race interaction; these results did not appreciably deviate from the results in column 2.

[‖]We consider segregation as a possible endogenous feature of city-size given city-size's salience as an ecological correlate of segregation in much of the segregation literature (22–26) as well as given research suggesting the number of political jurisdictions in a region (which tend to be more numerous in larger urban areas) is causally linked to segregation (27, 28).

[**]We also show a similar descriptive result in *SI Appendix*. For workers in our sample, the Black–White and Latinx–White differences in average wages are very high in our large urban areas compared to the 10 next largest urban areas and all other urban regions, whereas wage inequality in the 10 next biggest urban areas is more similar to all other urban regions. The fact that there is less racial inequality in the value of experience in the 10 next biggest urban areas relative to all other urban areas is consistent with this descriptive result.

Researchers often specify wage equations in logs, but for our purposes, this transformation would introduce distortions. This is because the log transformation changes the interpretation of regression coefficients from changes in levels to changes in growth rates (i.e. by what percent does Y change given a 1 unit change in X). When making comparisons across groups (e.g. race) and geography (e.g. big versus small urban areas) this is problematic, because the average wage levels across people and places tend to be very different, so differences in growth rates may not say much about inequality as it is actually experienced by workers. Indeed, in the difference-in-difference context (which is similar to our own), depending on the difference in the distributions of treated and control groups' wages, the coefficients for regressions in logs and levels can have opposite signs (29).

Research that addresses substantive issues similar to the present work shows that while in logs women may have a greater urban wage premium than men, in levels the opposite is true, because women's wages are so much lower than men's to begin with (7). In such a case it would be problematic to conclude that there is less gender inequality in bigger urban areas, though a log specification would lead one to do so. Thus, we focus on wages in levels rather than logs. That being said, interested readers can refer to *SI Appendix* where we show results with our dependent variable specified in logs. We find that there are no longer statistically significant differences in the value of large urban area work experience for Black workers relative to White workers, while the coefficient for *Large Urban Area Experience* Latinx* remains negative and significant. The former result is not entirely surprising given Black workers' far lower average hourly wages compared to White workers ($21.12 versus $30.08 in our sample). This suggests that lower wages at the beginning of their working lives may create a long-term barrier for Black workers to catch up to White workers through experience from working in large urban areas. In this light, rectifying these inequalities may require higher initial wage offers to Black workers, and not just equalizing subsequent returns to further experience. Moreover, the fact that the Latinx–White inequalities we document in this paper remain even when focusing on differences in growth rates is a striking result, given that Latinx workers also have substantially lower starting wages (an average of $24.31 in our sample) than White workers. These results are consistent with the fact that the relative wages of Black workers to White workers (i.e. average Black/average White wages) tend to be quite similar across locations, whereas the Latinx/White ratio is much higher in small than in big urban areas (*SI Appendix*, Table S2).

Discussion: Deepening our Understanding of Racial Differences in the Economic Benefits of Working in Large Urban Areas

In this paper, we have documented that there are substantial racial disparities in the rewards that workers reap from working in large urban regions. But why would this be the case? One possibility is that the observed disparities are attributable to selection on characteristics of workers that we cannot observe here. Economists are often concerned with whether workers of different "ability" levels sort into urban areas of different sizes (1, 17). Imagine, for example, that low ability Black and Latinx and high ability White workers move to big urban areas, while high ability Black and Latinx and low ability White workers move to small urban areas. As noted, and in concert with the literature (2, 30), we included worker fixed effects to address selection on unobserved characteristics. It is conceivable that such worker fixed effects do not entirely capture this unobserved heterogeneity, however, if there is a great deal of mobility between urban areas, and this is combined with unobserved differences between the White and non-White populations who move to big versus small urban areas. In our view, there are several reasons to be reserved about this interpretation. First, "ability" is neither a static nor innate feature of individuals; individual attributes that we commonly label as "skill," "effort," or "motivation" can change over time and may be responses by an individual to their social and spatial contexts. As an example of this, consider the possibility that workers from marginalized groups may reduce their effort, or their investment in acquiring skills, if they believe they will face discrimination, reducing or negating the return to such efforts (31). Moreover, large urban areas in the United States typically have substantial interneighborhood disparities in exposure to environments that influence individuals' skills, effort, access to social networks and information, and hence motivation (32, 33). Second, even if part of what we observe is due to racialized patterns of sorting according to unobserved individual characteristics across big and small urban areas, such spatial sorting would still be an integral dimension of the processes through which large urban areas end up fostering inequality (33). Finally, mobility and migration are hardly the norm. Over the life span, most people live in the same urban regions in childhood and adulthood. Indeed, of the respondents in our sample, about two-thirds live in the same labor market at age 14 as at the start of our study in 1993,[††] and only about 10% ever move from a large to a non-large urban area or vice versa. We are thus observing processes that, in the vast majority of cases, occur over workers' lives differently in big as compared to small urban regions.

Another possibility is that there are such finely grained differences in skills and experience that it is impractical to observe them, and that they are endogenous to race. These very subtle differences could, for example, be due to discrimination once a person is in an occupation, or at the time they move from one job to another, within or across occupations. In this case, workers' skills and experience somehow become qualitatively different across race, reflected in disparities in the accumulation of or fine-tuning of skills and experience. Alternatively, it could be that workers are remunerated differently for the skills and experience they possess and deploy, within or across jobs, but in ways that we are unable to observe from outside the immediate work context (disparities in valuation). In this paper, we have considered these possibilities to the extent possible with observational data, but it may be that through promotions, job mobility, network effects, or some other channel, Black and Latinx workers are not given the same opportunities to acquire and/or utilize skills and experience as White workers. One promising avenue of future inquiry suggested by this research is to unpack in a more granular way which detailed occupations have strong racial disparities in experience premiums.

Beyond the occupational structure of urban areas that we explore in this paper, it may be that the spatial structure of city-regions comes in to play. A growing body of evidence suggests that there are ways in which the spatial structure of large, dense urban areas shapes patterns of residence, work, and commuting in ways that establish barriers to non-White workers in accessing employment and other economic opportunities, as compared to White workers with the same observable skills and in the same occupations (7, 34–36). Similar to other research (36) suggesting that Black–White commuting inequality is exacerbated by urban

[††] Location information was available for about 80% of our sample in both years.

areas' overall population and high cost-of-living, we find that high cost-of-living appears to be a channel through which larger urban populations may contribute to experience inequalities in the labor market. The combination of a large population and high cost-of-living may be particularly potent if it allocates workers within an urban area in ways that provide racially uneven access to labor market opportunities. Further research should follow up on this potential causal channel.

To conclude, race and the economy are intertwined in ways that are often subtle and difficult to detect. Yet, subtle initial differences can multiply up to large cumulative impacts on inequalities. Social scientists are increasingly unpacking these subtle forces, ranging from work on racial disparities in "exposure" to different kinds of environments (32, 33, 37), to racial differences in the composition and mobilization of job referral networks (38, 39) to how social networks, lived experiences, and the media shape the places where we choose to live (40), to name a few. Research has also shown that urban work experience provides a powerful opportunity machine, and this may combine with important intergenerational advantages of externalities that are "in the air" in some city-regions today (2, 14, 41, 42). This picture is nuanced by the fact that urban wage premiums and the urban concentration of college-educated workers contribute to the interpersonal and geographical income disparities that characterize the current age. Skill-biased technological change has both privileged workers in high skill occupations and made large urban areas more important as motors of the economy (14, 42). Yet, as we have seen, these increasing advantages of large urban areas and high skill occupations have largely been captured by White workers, leading to rising racial inequality that is distinctly urban and skill-biased. If this trend continues, we may expect racial wage inequality to continue to increase, particularly in large urban areas, as we saw in Fig. 1. For many Black and Latinx workers, even those who locate in large urban areas and work in high-skill occupations, equitable rewards may not come.

Materials and Methods

Data. The primary data source for this research is the NLSY79 microdata. This survey follows 12,686 workers who were between the ages of 14 and 22 in 1979. Surveys were conducted annually between 1979 and 1994 and biannually thereafter. We focus on the survey rounds between 1994 and 2018 for consistency, as well as because these were respondents' prime working years. The original NLSY79 consisted of 3 samples: i) a cross-sectional sample of 6,111 Black, Latinx, and non-Black/non-Latinx youths designed to represent the noninstitutionalized U.S. civilian population ii) a supplemental sample of 5,295 Latinx, Black, and economically disadvantaged non-Black/non-Latinx youths of the same age (though none of the 1,643 economically disadvantaged non-Black/non-Latinx respondents were interviewed after 1990) and iii) a supplemental sample of 1,280 respondents who were serving in the military in 1978, of which 1,079 were dropped (leaving 201) following the 1984 survey.[‡‡] To identify White respondents in the survey, we excluded anyone in the non-Black/non-Latinx group who reported Asian or Native American as their primary ancestry, while Black and Latinx respondents were identified by NLSY79 screeners through a set of classification guidelines (43). We draw on all three of the above samples for the years 1994–2018, though respondents can drop out of the survey if they do not respond in a given year, and were also excluded if they did not work at least 40 30 h work weeks in a given year or have a (2017 inflation adjusted) wage and salary income over $1,000. In total, our sample consisted of 7,341 respondents who worked full-time for at least 2 y between 1994 and 2018, for a total of 57,897 person-years. Of these, 2,214 respondents were Black, 1,470 were Latinx (identified as Hispanic in the survey), and 3,657 were White. A descriptive statistics table is available in *SI Appendix*.

Our dependent variable *Hourly Income* was calculated using workers' annual income from wages and salaries. Respondents were asked to report their income for the previous calendar year, so while we focus on wage disparities using data from the 1994 to 2018 surveys, our income values correspond to the years 1993 to 2017. Accordingly, when we refer to experience below, for a respondent's income in 1993, we are referring to how much experience they had as of the beginning of 1993. Income values were adjusted for inflation to 2017 dollars using the Bureau of Labor Statistics consumer price index for all urban consumers, and then divided by the number of hours the respondent reported working that year from the weekly hours array.

One of the richest components of the NLSY79 is the Work History Data, which entails a set of weekly arrays containing a code for each job a respondent reported working in each week, as well as the total number of hours they worked in all jobs. These job codes can further be linked to the occupation of that respondent's primary job (using the NLSY79 Employer History Roster). We used these data to construct our main independent variables. More specifically, we calculated *All Experience* for each year as the number of weeks a respondent reported working at least 30 h divided by 52, and then accumulated this through the prior year. So for example, if through the year 1999 a respondent had worked a total of 100 wk, their value for *All Experience* in 2000 would be 1.92 ($100/52 = 1.92$). While respondents' annual incomes are not reported for years they did not interview, a useful feature of the survey is that following noninterview years, respondents' work histories are backfilled. This means that work experience is updated up to a respondent's most recent interview, making it possible to know their entire work history.

To calculate *Large Urban Area Experience* required access to the NLSY79 restricted-access geocode files. These files contain respondents' county at each survey round which we used to link respondents to labor markets. For all survey years, we assumed respondents were in the same labor market that they reported at the time of the survey, so all work experience for a year in which the respondent was interviewed would correspond to the labor market at the time of the interview. Following the 1994 survey, respondents were interviewed biannually. We thus assigned half of the experience for the year in which no survey was conducted to the labor market they were in during the previous survey round, and half to the one they were in during the present round. For example, if a respondent worked 40 wk during a non-survey year, and switched from a non-large to a large labor market, only 20 wk would be counted as *Large Urban Area Experience*. In cases where multiple years elapsed between interviews for a particular respondent and county data was missing, we considered work experience to be outside a large labor market.

For occupations, we again used the Work History Data, focusing on the job in which each respondent reported working the most hours in a given week. For each person-week, we then cross-walked their occupation to "high," "mid," and "low skill" categories using a common approach in the literature (12, 14, 15). To get a unique occupation category for each person-year, we used the occupation in which they reported working the most ($\geq$30 h) weeks that year. However, when calculating *High Skill Experience*, we allowed all weeks of experience in which a respondent primarily worked in a high skill occupation to count toward this value, regardless of whether a respondent worked the most weeks in a high skill occupation for a given year. In rare cases, it is not possible to link a given job to an occupation. This can occur when a respondent worked less than 10 wk in a job, or in a very limited number of cases because of undocumented codes in the NLSY data (i.e. NLSY occupation codes that have no corresponding value in the census occupation codes from which they are drawn). Ultimately, this resulted in only about 1 percent of person-years in our data having missing occupations (*SI Appendix*).

Our final independent variable is *New Jobs*. This came from the NLSY79 Employer History Roster, and measures the number of jobs a respondent has reported working in. As with the experience variables, we considered the number of jobs a respondent has had (since 1978) as of the beginning of a given year.

Finally, as our measure of labor markets we used a combination of Metropolitan Statistical Areas (MSAs) and Combined Statistical Areas (CSAs) as they were defined following the 2010 Decennial Census. MSAs are defined as one or more counties with substantial commuting interchange and an urban

[‡‡] Here we note that the NLSY79 survey has survey weights for each respondent in each year they responded to the survey. We do not include these weights in our regressions, as doing so does not appreciably change our main conclusions and because not all statistical packages are able to implement both the weights and robust SEs.

core of at least 50,000 people. Combined Statistical Areas are defined as combinations of adjacent MSAs and/or Micropolitan Statistical Areas (MicroSAs: defined similarly to MSAs but with a minimum urban core of only 10,000 people) with a commuting interchange of at least 15 percent. We excluded CSAs that were only made up of MicroSAs (i.e. every CSA in our data has at least 1 MSA). This approach is advantageous as it includes several major MSAs that are not part of a CSA (e.g. Phoenix, Austin) while also considering the whole economic region that MSAs are a part of. Additionally, it also excludes MicroSAs which are very small and not comparable to major urban labor markets (a challenge when using Commuting Zones which is another common approach). This left us with 275 labor markets, though respondents outside one of these labor markets were still included in our analysis (with one common labor market fixed effect).

Ultimately, for our purposes what matters is the definition of "large" labor markets, as experience in any other location is considered "non-large urban area" experience. We defined labor markets with over 6 million people as "large urban areas." In subsequent models (Table 2), we also identified the 10 urban areas outside our large urban areas with the highest levels of segregation (measured using the isolation index–the share of same-race population in a census tract for a group on average), population density, cost-of-living (measured as median contract rent), and mean commute times. All urban characteristics were measured using 5-y American Community Survey (ACS) summary data for 2017 (10). The one exception is mean commute times, which was measured with 2017 5-y microdata (11) for workers between the ages of 25 and 65, with an income over $1,000, who worked at least 30 h a week and 48 wk in the previous year, and crosswalked from Public-Use Microdata Areas (the smallest geographic unit in ACS microdata) to our labor markets using the same weighting procedure from ref. 12.[§§]

Model. The main specification is as follows:

$$\begin{aligned} &Hourly\ Income_{it} \\ &\quad = \beta_1 All\ Experience_{it} * Race_i + \beta_2 Large\ Urban\ Area\ Experience_{it} \\ &\qquad * Race_i + \beta_3 In\ Large\ Urban\ Area_{it} * Race_i + \gamma_i + \alpha_t + \mu_j + \epsilon_{itj}, \end{aligned}$$

where $Hourly\ Income_{it}$ is the wage and salary income of worker i in year t, $All\ Experience_{it}$ is the total work experience (in years) of that same worker, $Large\ Urban\ Area\ Experience_{it}$ is that worker's experience in a big labor market, and $In\ Large\ Urban\ Area_{it}$ is whether a worker is currently in a big labor market. Our main interest is in the interaction between race and work experience, and particularly race and large urban area work experience, which is measured by the parameter β_2. A worker's race does not vary over time, and thus it cannot typically be included in a model with worker fixed effects (γ_i). However, time-invariant variables like race can be interacted with variables that do vary over time, such as work experience. Once this interaction is included, the main effects for *All Experience* and *Large Urban Area Experience* refer to the relationship between additional work experience and income for White workers, while the interaction coefficients show how this relationship is different for Black and Latinx workers relative to White workers. The impact of *Large Urban Area Experience* is interpreted relative to non-large urban area experience. So the main effect thus tells us how much each additional year of large urban area work experience is worth relative to non-large urban area experience for White workers, conditional on overall experience, whether they are in a large urban area, worker, year, and labor market fixed effects,

Finally, ϵ_{ijt} is an idiosyncratic error term while γ_i, α_t, and μ_j, are worker, year, and labor market fixed effects respectively. As stated previously, an advantage of the NLSY79 is that it allows us to follow the same workers over time. By including worker fixed effects, we are thus able to estimate the impacts of accumulating additional work experience over workers' working lives, rather than between different workers at one point in time, as well as control for time-invariant observable (e.g. initial differences in education, gender) and unobservable (e.g. ability, motivation) characteristics that may cause some workers' wages to be higher than others. Including these fixed effects also allows us to control for idiosyncratic shocks that impact wages in specific years as well as any bias that may arise from workers' migration into different types of urban areas.

In subsequent models, we also add additional controls for occupations, job mobility, and experience in high skill occupations to parse out possible channels through which large urban area experience may be more valuable for some workers than others. Because we include a fixed effect for each worker γ_i these measure the impact of within-worker switches in occupations and jobs, as well as within-worker accumulation of high skill experience, rather than differences in the value of certain occupations, new jobs, or experience in high skill occupations between workers.

Finally, researchers sometimes model experience effects with a quadratic term under the premise that wages increase rapidly at the beginning of workers' careers, before leveling off later in their careers. We chose not to do so as this nearly doubles the number of coefficients in our tables, but also because there are many occupations where wage changes tend to increase year to year in levels over time, suggesting the quadratic term could be both negative or positive. That having been said, *SI Appendix* reports our main results including a quadratic term for experience, and if anything suggests somewhat larger racial disparities in the value of large urban area work experience.

Data, Materials, and Software Availability. Some study data are available. This paper uses restricted access geocode data from the National Longitudinal Survey of Youth, 1979. This requires an application process, an agreement between the user's institution and the Bureau of Labor Statistics (who administers the data), and then analyzing the data from a virtual enclave at the recipient's institution after the agreement is approved. Our replication files include information on how to access the data as well as code to clean and analyze the data (much of which is publicly accessible). See https://doi.org/10.3886/E211941V1 (44).

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[§§] Here, we note that because we are working with restricted-use data from the NLSY, we are not allowed to reveal the exact names of the urban areas that correspond to each of the categories above.

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