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Disparities in food insecurity among Black and White households: An analysis by age cohort, poverty, education, and home ownership

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Abstract

We use the Current Population Survey's Food Security Supplement data to investigate food insecurity disparities among Black and White households across different age groups and socioeconomic characteristics. We find that disparities in the probability of food insecurity between Black and White households vary considerably across specific socioeconomic strata, in particular education, poverty status, and home ownership. Black households are systematically more food insecure than White, even when conditioning on other attributes, and even once household heterogeneity is eliminated. Thus, factors beyond socioeconomic characteristics may be more important in determining food insecurity disparities across Black and White households.

KEYWORDS

black households, coarsened exact matching, food insecurity, stratification analysis

JEL CLASSIFICATION

J15, I32

Food insecurity, defined as the limited or uncertain ability of individuals or households to obtain adequate nutrition, is a significant concern for many households in the United States (Coleman-Jensen et al., 2016). In 2020, about 10.5 percent of US households were food insecure (Coleman-Jensen et al., 2021). Health outcomes associated with food insecurity (FI) include lower dietary quality, the worsening of both physical and mental health (Essien et al., 2016; Vozoris & Tarasuk, 2003), and higher all-cause mortality (Walker et al., 2019). Black households are more than twice as likely as White households to be food insecure. In 2020, households with White, non-Hispanic adults reported a 7.1% prevalence of FI, and White, Hispanic households 8.8%. In the same year, 21.7% percent of households with Black, non-Hispanic, and 17.2% of Black, Hispanic households were found to be food insecure (Coleman-Jensen et al., 2021). Such a large disparity in FI between Black and White households calls for a deeper examination of this phenomenon.

Previous research finds that higher levels of FI among Black households persist even after controlling for potential confounders (inter alia, Bartfeld & Dunifon, 2006; Burke et al., 2018; Birkenmaier et al., 2016; Morales et al., 2021; Myers & Painter, 2017; Odoms-Young, 2018). However, most research comparing FI across racial groups focus on the ceteris paribus contribution of indicator variables representing different racial groups to the probability of being food insecure, disregarding the potential heterogeneity of this relationship, which may be exacerbated in some subgroups of the population (e.g., low-income or less educated households).

Additionally, some authors make the case that the persistent differences in FI across Black and White households may be due to structural factors other than individual attributes, referred to as "structural racism" (Bowen et al., 2021; Myers & Painter, 2017; Odoms-Young, 2018).[1] Thus, to design specific policies to reduce the racial gap in FI, it becomes important to understand whether this gap is more prominent in specific subgroups of the population more than others, what are its drivers, and if it persists once individual (observable) factors associated with it are controlled for.

In this paper, we attempt to investigate the heterogeneous nature of FI disparities among Black and White households in the United States using 19 years (1998–2016) of the Current Population Survey's Food Security Supplement dataset. We make three main contributions to the literature analyzing racial FI disparities in the United States.

First, we go beyond the binary variable approach most widely used to control for racial differences and instead stratify by poverty status, educational attainment, or home ownership to understand differences in a household's predicted probability of experiencing FI (PPFI). The stratification analysis reveals whether differences in PPFI across Black and White households become less or more prominent across subgroups of the population, and whether the magnitude of the relationship between specific variables and the probability of FI for Black and White households changes across strata.

Second, we control for different individual factors that may in part drive the differences in FI between Black and White households by analyzing a sample of households matched on observable factors using coarsened exact matching (CEM; Iacus et al., 2012). If structural racism is a large contributor to FI disparities, we expect that, once Black and White households are matched on observable characteristics contributing to the racial disparities in FI, the estimated gaps in PPFI of Black and White households should decrease. Also, we expect that the relationship between observable factors used for matching and the probability of experiencing FI of Black and White households should be the same in the CEM sample. Finding statistically significant differences in Black and White households' PPFI after matching may indicate that unobservable factors contribute to the FI racial gap.

Third, we investigate age-specific disparities in FI between Black and White households, as socioeconomic factors can have differential effects on health outcomes during the lifetime of an individual (Braveman et al., 2005). Previously, researchers have investigated the relationship between age and FI, but they have not controlled for racial differences in age cohorts. We use 13 five-year race-specific age cohorts to account for social and economic differences that may influence a household's PPFI at different age levels, and to determine whether different age gradients of FI exist for Black and White households.

Our results show that ceteris paribus, Black households have a much larger PPFI than Whites. The gap in PPFI appears consistent across age groups, although it widens for the oldest cohorts. Also, the PPFI follows an inverted U-shape pattern across age cohorts for both race groups. The highest PPFI for Black households emerges in the 45–50 age cohort and in the 40–44 cohort for White households. Further, the decline in PPFI for older White households is more marked than for Black ones. These patterns of PPFI are consistent with the magnitude of estimated marginal effects of the age cohorts on the probability of being FI for Black and White households as well. While there is a negative and statistically significant relationship between ages 70 and older and FI probability for White households, the only negative and statistically significant association between age groups and FI for Black households is found for the 80 and above age cohort. That is, the widely documented decline in FI across age cohorts (see e.g., Berning et al., 2022; Ziliak & Gundersen, 2016) is more marked for White than Black households, which may be reflective of the history of racism that older Black households have endured.

Across all age cohorts, White households characterized by higher education, higher income, or homeownership show the lowest PPFI, whereas Black households with lower education levels, lower income, or who are not homeowners have the highest PPFI. Non-poor Black households have a lower PPFI than poor White households; however, they have a higher PPFI than non-poor White households. We also find that Black households with high education levels have similar PPFI than White households with low education across most age cohorts. Similarly, Black households that are homeowners have, for several of the age cohorts, the same PPFI as White households who do not own a home, and even higher PPFI at the oldest age cohorts. Thus, educational attainment and home ownership appear less effective at reducing the racial FI gap across the entire age distribution.

When we compare Black and White non-poor households who also have higher education and own their homes (referred to here as *high outcome* households) to poor households with lower education and who do not own a home (*low outcome*), we find that even though high outcome Black households show much lower PPFI than low outcome ones, they have significantly higher PPFI than high-outcome White households. Additionally, low-outcome Black households have the same PPFI as low-outcome White households for most of the age cohorts considered.

Finally, the results of the analysis performed on the matched sample show that the racial gap in PPFI persists after White households are matched to Black households on several observable characteristics. Additionally, most of the estimated marginal effects of age cohorts and education levels show the same magnitude for Black and White households using the matched sample. This suggests unobserved factors may be contributing to the racial disparity in FI.

Altogether our results suggest that investing in policies to ameliorate negative household challenges (i.e., poverty relief programs, education incentives, and homeownership programs) may help mitigate the gap in FI between Black and White households, although their effectiveness may vary depending upon the age of the household. Such policies may be inadequate to eliminate the racial FI gap, however, and additional research is needed to understand what

other factors (e.g., structural and institutional) contribute to the persistence of this gap across age groups, poverty status, education level, and household wealth.

The rest of the paper unfolds as follows: next, we discuss the data and modifications made to the sample. Then we describe how we apply the empirical methods—stratification analysis and CEM—to the sample. We follow with results and discussion in a policy context and finally our conclusions.

DATA

We use the Current Population Survey's Food Security Supplement (CPS-FSS) from 1998–2016 (Flood et al., 2020). The CPS-FSS includes responses to a 10-item questionnaire for households without children, plus eight additional questions for households with children, to classify a respondent's household as being food secure, low food secure, and very low food secure (Coleman-Jensen et al., 2021). We use responses from a household head or their spouse to

TABLE 1 Summary statistics using household CPS-FSS weights

	Mean values	
Variable	**Black households**	**White households**
FI	0.237	0.108
Poor	0.428	0.261
Age	46.672	50.427
Female	0.598	0.471
Child present	0.445	0.392
Family size	2.407	2.426
Married	0.276	0.525
Retired	0.151	0.22
Veteran	0.097	0.137
Own home	0.459	0.7
Education		
HS degree	0.527	0.438
Associate	0.097	0.104
Bachelor's	0.139	0.216
Advanced	0.08	0.143
Income		
Not reported	0.116	0.107
<$25 k	0.403	0.235
$25 k–$60 k	0.313	0.329
$60 k–$100 k	0.118	0.208
>$100 k	0.049	0.121
Metro status	0.89	0.812
Observations	78,412	676,261

create a binary indicator identifying food insecure households by assigning a value of one to those households reporting low and very low food security status, zero otherwise.

The CPS-FSS also includes a large number of sociodemographic characteristics of the respondents and their households. As our goal is to assess the drivers of FI disparities between Black and White households, we only retain in our data households that can be classified as either Black or White, based on how household head and their spouse self-identify. We identify a household as Black (White) if the head and spouse both identify only as Black (White). Households with mixed race members and those belonging to other racial and ethnic groups are not included in the analysis.[2]

We categorize households into 13 five-year age cohorts based on the head of household age: the first age cohort includes households with a head 20–24 years old, the second households' head 25–29 years old, and so on, with the last (thirteenth) cohort including household heads 80 years of age and above. We drop households with heads younger than 20 years. We identify households as "poor" and "nonpoor" based on whether they are below or above 185 percent of the federal poverty level.[3]

In our analyses, we use the CPS household food security status weight. We provide weighted means of our key variables in Table 1. FI is more than twice as prevalent among Black households compared with White households. A much larger share of Black households in our data are below the poverty line compared with White and belong to lower income brackets; they also tend to be younger and have a larger share of female head respondents. While a larger share of Black households has children present in the households, they have a slightly lower family size, and a smaller share are married, have a veteran in their household, and own a home. In terms of education level, a larger share of Black households has only a high school degree compared with White households, and a lower share has any college-level degrees.

EMPIRICAL METHODS

We model the probability that household i in state s and year t belongs to group g (where g represents either Black or White) experiences FI as:

$$\mathrm{FI}_{ist}^{g} = \sum_{g} \left(\beta^{g} X_{ist}^{g} + \gamma^{g} AC_{ist}^{g} + \delta_{t}^{g} + \lambda_{s}^{g}\right) + \varepsilon_{ist}, \tag{1}$$

where FI is food security status (FI = 1 if food insecure, 0 otherwise), X is a vector of sociodemographic characteristics of either the household, or the household head, which includes: family size, presence of children, marriage status, retirement status, veteran status, home ownership status, education indicators (high school, associate degree, bachelor, or advanced degree), income levels, metro status, and 1 of 26 occupation category indicators.

We include the vector of age cohort indicators (AC) to control for differences in FI between households at different points in their lives. Recent work by Berning et al. (2022) shows that FI incidence for all households follows a nonlinear path across ages, reaching its lowest levels after 80. We also include year and state indicator variables to control for space- and time-invariant factors that can be related to FI probability. All parameters ($\beta, \gamma, \delta,$ and λ) are group specific, including year and state effects.

We estimate Equation (1) using a logit estimator. Using the estimates from Equation (1), we predict the mean and standard deviation of the conditional probability that a household in

group g belonging to a given age cohort is food insecure, or the predicted probability of food insecurity—PPFI. We use these predictions to compare conditional estimates of FI across Black and White households across age cohorts and demographic strata. Further, we estimate marginal effects of selected covariates in the model to assess whether different household characteristics across Black and White households have different impacts (returns) on the FI of Black and White households.

Stratification analysis

To provide greater insight into the role certain socioeconomic characteristics play in FI outcomes, we stratify our sample. Specifically, we compare the PPFI across groups defined by key socioeconomic characteristics known to be associated with FI and examine how marginal effects of selected covariates on the probability of FI across Black and White households vary across strata.

Previous research finds that low educational attainment is positively associated with FI (Daponte & Stephens, 2004; Rose et al., 1998). Thus, we compare the PPFI of Black and White households with low education (less than a bachelor's degree) and high education (a bachelor's degree or higher). To define the education level in married households, we use the highest education attained by either spouse. Next, we estimate the PPFI for Black and White households that are above and below the 185 percent poverty threshold. Gundersen and Gruber (2001) find that recent changes in income are associated with being food insecure. Similarly, Daponte and Stephens (2004) find unemployment being associated with FI. Accumulating wealth can help protect against the effects of income fluctuations and may reflect long-term available resources (Cubbin et al., 2011). The CPS data have limited information on household wealth. Therefore, we compare the PPFI of black and white households that report owning a home and those that do not, as a proxy for wealth. Home ownership is also associated with lower rates of FI (Rose et al., 1998).[4] Finally, we compare households that are high education, non-poor, *and* own a home (which we call *high outcome*) to those with low education, poor, *and* who do not own a home (*low outcome*).

Coarsened exact matching sample

Controlling for socioeconomic characteristics may fail to capture nonlinear effects of socioeconomic factors associated with FI. For instance, Braveman et al. (2005) show that, at every education level, Black adults have significantly lower mean income compared with White adults. This suggests differential returns to education through income and occupation.

We use CEM to create a sample of Black and White households that are balanced across observable characteristics (Stuart, 2010). CEM allows matching of households using variables that are more or less relaxed (Iacus et al., 2012). That is, users can match on specific criteria (e.g., married or not) or a broad criterion (e.g., income ranges). Matching in this way improves the balance of data by forcing the distribution of observed explanatory variables between the treated (in our case, Black households) and the control group (White households) to be similar (Iacus et al., 2011). As a result, the distribution of unobservable characteristics that are related to the observable characteristics is forced into similar distributions between groups.

TABLE 2 Coarsened exact matching statistics

	White		Black		
	Observations	**Share**	**Observations**	**Share**	**Balance**
Unmatched	484,913	71.7%	21,116	26.9%	0.7662
Matched	191,348	28.3%	57,296	73.1%	2.49 E-13
Total	676,261		78,412		

TABLE 3 Summary statistics for households matched using coarsened exact matching (CEM) and CEM sampling weights

	Mean values	
Variable	**Black households**	**White households**
FI	0.246	0.193
Poor	0.492	0.462
Age	49.524	49.533
Female	0.616	0.569
Child present	0.425	0.342
Family size	2.337	2.074
Married[a]	0.268	0.268
Retired	0.222	0.234
Veteran	0.102	0.111
Own home[a]	0.493	0.493
Education[a]		
HS degree	0.566	0.566
Associate	0.066	0.066
Bachelor's	0.121	0.121
Advanced	0.075	0.075
Income[a]		
Not reported	0.064	0.064
<$25 k	0.46	0.46
$25 k–$60 k	0.322	0.322
$60 k–$100 k	0.109	0.109
>$100 k	0.044	0.044
Metro status	0.873	0.793
Observations	57,296	191,348

[a]Indicates variables used for matching in addition to age cohort, occupation, and state.

We use an exact match for household income categories, educational attainment, marital status, age cohort, occupational category of the household head, and state of residence. As a result, Black households with, for example, high educational attainment but mid-level income are only compared with identical White households. After matching Black and White households, we create weights

based on the matched strata. All Black households receive a weight value of 1, and all unmatched White households receive a weight of 0 and are excluded from the dataset. The remaining matched White households receive a weight between 0 and 1 that will normalize the variance in the distribution of the various combinations of characteristics across these households. As a result, the data set will see one Black household observation per several weighted White households.

To evaluate the balance of the CEM procedure, Iacus et al. (2008) developed an $\mathcal{L}_1$ statistic where $\mathcal{L}_1=0$ indicates perfect global balance across coarsened groups and $\mathcal{L}_1=1$ indicates separate groups and zero balance. The $\mathcal{L}_1$ value is meaningless by itself but can be used to compare whether the matching procedure improved balance. Table 2 shows the balance measure for the pre-matched sample and the matched sample. The pre-matched sample had an $\mathcal{L}_1=0.766$ After we matched households, the $\mathcal{L}_1$ is virtually zero, indicating that the sample resulting from the CEM procedure has near perfect balance between Black and White households.

We further assess the balance of the data by comparing the summary statistics of the matched samples using the created matching weights (Table 3). In the CEM sample, the share of married household heads, home ownership, education, and income levels are all virtually identical between Black and White households. The difference in the rate of FI and poverty between Black and White households is smaller within the matched sample than in the full sample, suggesting that matching helps to improve the balance between the two groups.

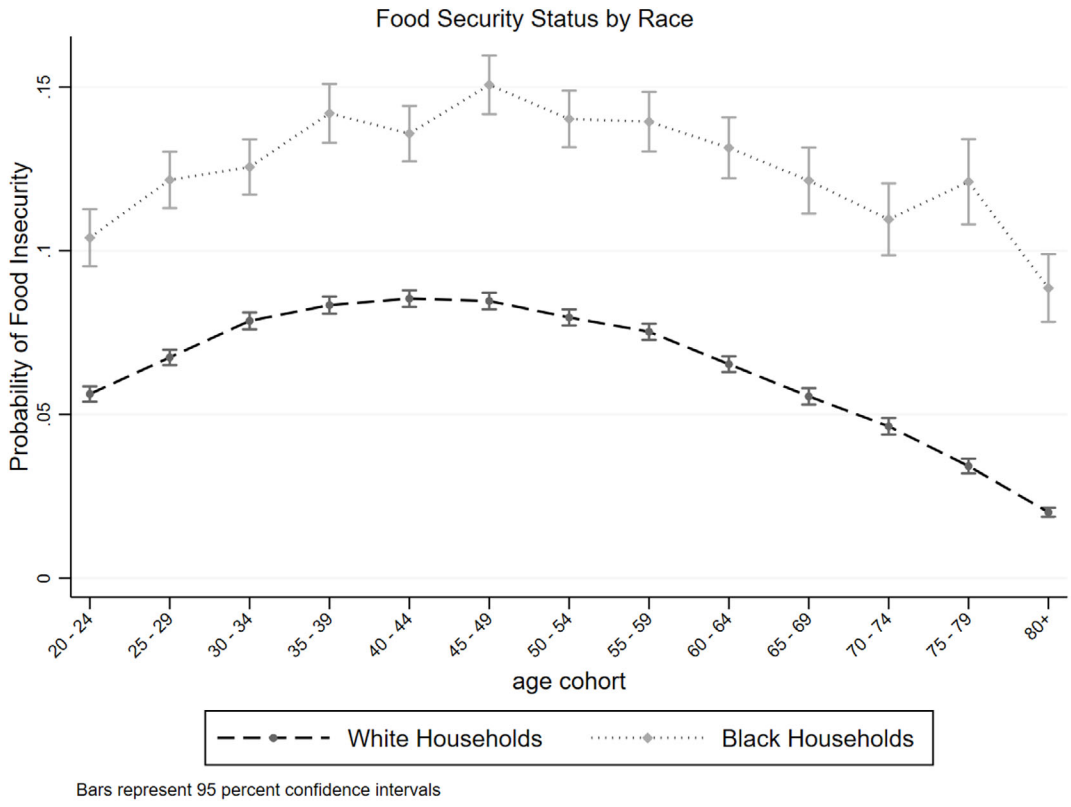

FIGURE 1 Predicted probability of food insecurity (PPFI) of Black and White households by age cohorts

TABLE 4 Marginal effects of age cohorts on Black and White household FI probability: Full sample

	Black households	White households	H_0: $\beta^{Black} = \beta^{White}$
25–29	0.025***	0.010***	Fail to Reject
	(0.008)	(0.001)	
30–34	0.031***	0.020***	Fail to Reject
	(0.008)	(0.001)	
35–39	0.054***	0.025***	Reject
	(0.008)	(0.002)	
40–44	0.045***	0.026***	Reject
	(0.008)	(0.001)	
45–49	0.066***	0.026***	Reject
	(0.008)	(0.001)	
50–54	0.052***	0.021***	Reject
	(0.008)	(0.001)	
55–59	0.051***	0.017***	Reject
	(0.008)	(0.001)	
60–64	0.039***	0.008***	Reject
	(0.009)	(0.002)	
65–69	0.025***	−0.001	Reject
	(0.010)	(0.002)	
70–74	0.008	−0.009***	Reject
	(0.010)	(0.002)	
75–79	0.025**	−0.020***	Fail to Reject
	(0.011)	(0.002)	
80 and above	−0.023**	−0.033***	Fail to Reject
	(0.010)	(0.001)	

Note: Estimates are average marginal effects. Standard errors in parenthesis. ***, **, and *, represent, respectively, a marginal effect statistically different from 0 at the 1%, 5%, and 10% levels, respectively. H_0: $\beta^{Black} = \beta^{White}$ test's null hypothesis: marginal effect for Black and White statistically the same.

EMPIRICAL RESULTS

We present the PPFI of Black and White households by age cohorts in Figure 1, along with their 95 percent confidence intervals. Detailed values of predicted probabilities are reported in the Appendix. We see that White households have a significantly lower PPFI at every age cohort than Black households. Black households' PPFI at each age cohort appears to be estimated less precisely (wider confidence intervals) than for White households.

While the PPFI declines for both groups of households at older age cohorts, White households see a larger PPFI reduction, which also begins sooner than Black households. Specifically, Black households' PPFI reaches its peak at age 45 (15.1 percent) and the minimum value (8.9 percent) at age 80 and above, which represents a reduction of 41 percent (Appendix S1).

Alternatively, White households' PPFI reaches its peak (8.5 percent) at age 40, and the lowest value (2 percent) at age 80 and above, for a 76 percent reduction.

Table 4 reports the average marginal effects of the age cohort indicators on Black and White households' probability of being FI. For most age cohorts the effect of belonging to a specific age group is different for Black and White households, except for the young (25–29 and 30–34) and the oldest ones (75–79 and 80 and above). The age cohorts' marginal effects are in general larger for Black households than White, this gap being the largest for the 55–59 cohort (5.1 percent marginal effect for Black households and 1.7 percent for Whites). The patterns of age cohorts' marginal effect are consistent with the inverse U-shaped pattern of PPFI illustrated above. These patterns show positive and increasing relationships until the 45–49 cohort, for a 2.6 percent marginal effect on White households' FI and 6.6 percent for Blacks; their magnitudes then declines until they become negative. Interestingly, while the first negative and statistically significant marginal effect of an age cohort for White households is found in the 70–74 age cohort (−0.9 percent), for Black households, we only have one negative and statistically significant marginal effect (80 and above cohort).

Overall, these patterns imply that (1) the effect of age on FI is different (and larger) for Black and White households except at young and elder age; and (2) that while it is typical for elderly

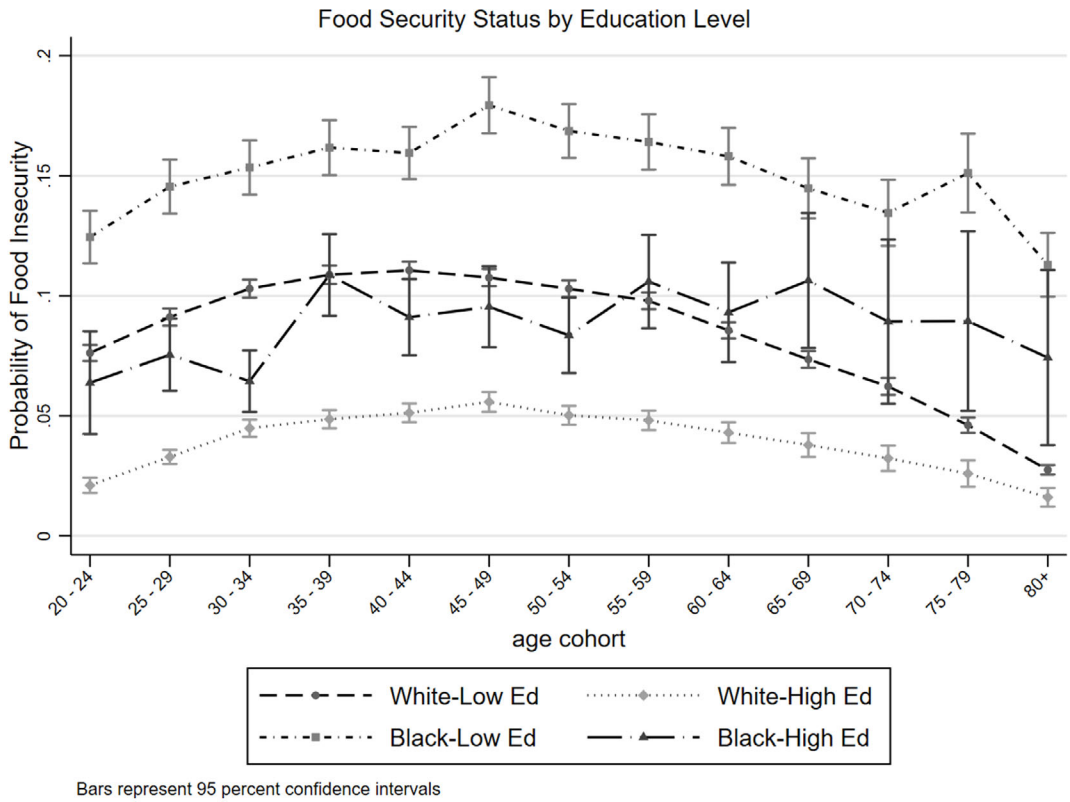

FIGURE 2 Predicted probability of food insecurity (PPFI) of Black and White households by age cohorts: Stratified samples by education level. High Ed are households with one household head that has a bachelor's degree or higher.

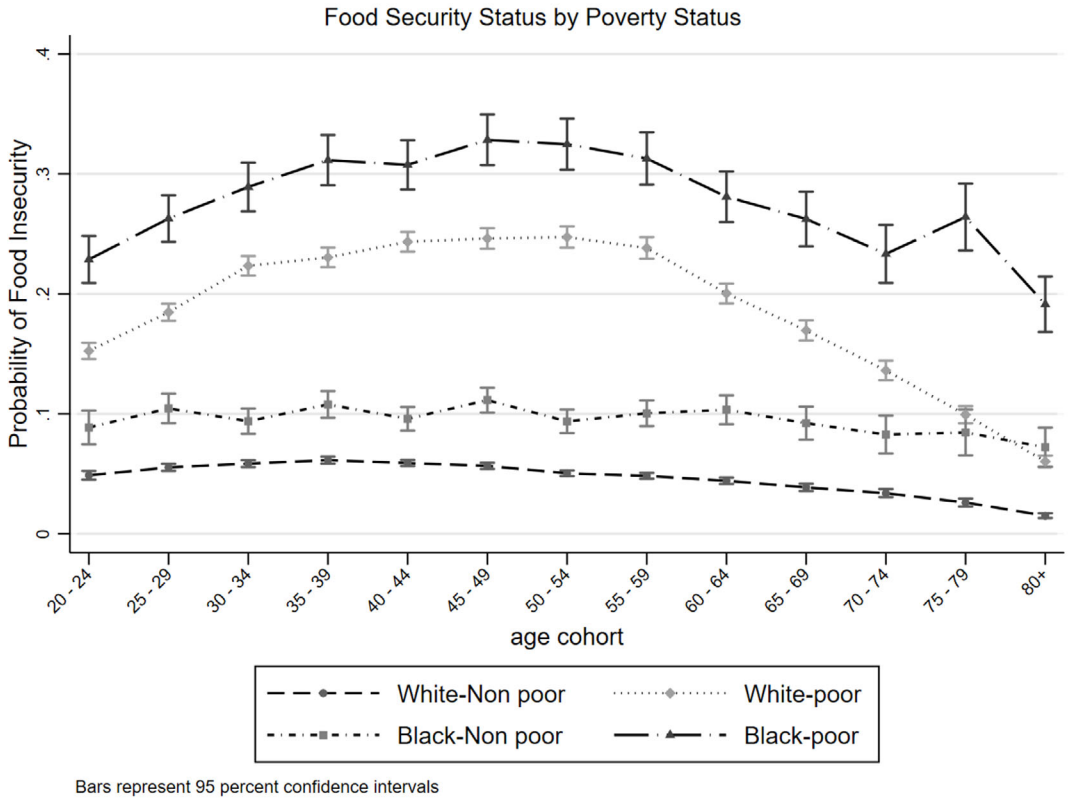

FIGURE 3 Predicted probability of food insecurity (PPFI) of Black and White households by age cohorts: Stratified samples by poverty status. Poor households are identified as below the 185 percent poverty line.

households to report greater food security (Berning et al., 2022), the transition to lower levels of FI is much more marked for White than Black households.

Stratification results

We first stratify the samples of Black and White households by education (Figure 2). We find that, across age groups, Black households with lower education are the least food secure and White households with higher education are consistently the most food secure. The gap in PPFI between Black and White households persists even within groups of similar education. For example, in the 45–49 age cohort, the PPFI of low-education, Black households is 17.9 percent versus 10.8 percent of low-education, White households (Appendix S2). The PPFI of high-education, Black households is 9.5 percent, whereas that for high-education Whites is 5.6 percent. Importantly, we find that across most age cohorts, low-education White households' PPFI is not statistically different than that of high-education Black households. Also, low-education White households have a lower PPFI in the two oldest cohorts. The gap between high and low-education households' PPFI decreases with age; however, the reduction is much more marked for White than Black households. It should be noted that the PPFI confidence intervals of high-education, Black households are particularly large for older age cohorts, probably due to the

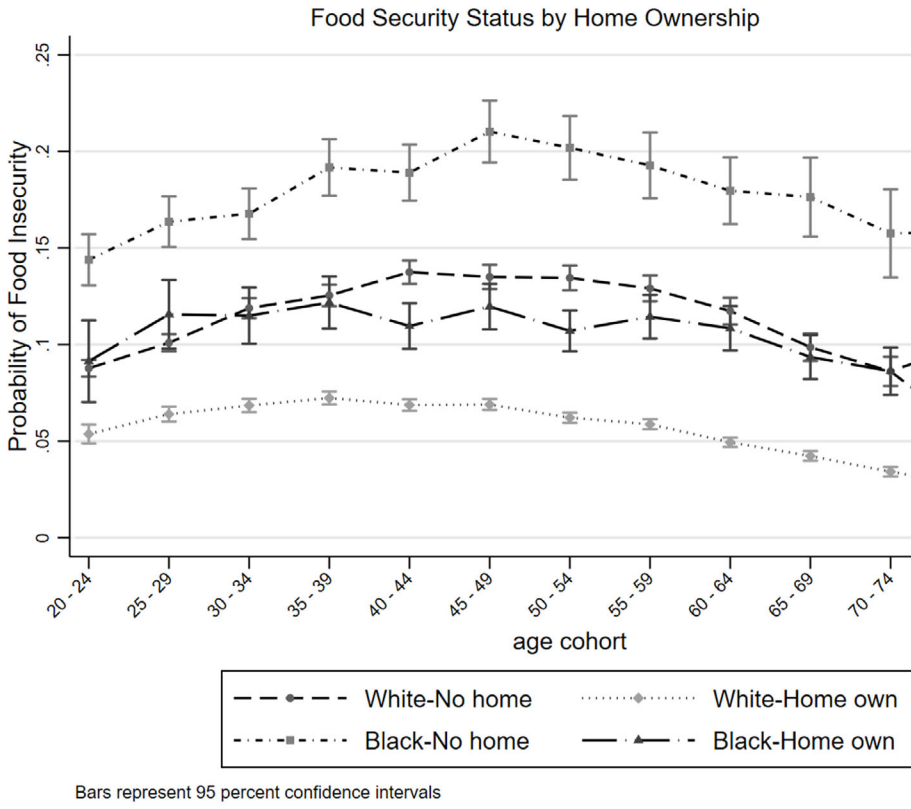

FIGURE 4 Predicted probability of food insecurity (PPFI) of Black and White households by age cohorts: Stratified samples by home ownership

small number of households falling in this group, a likely result of the barriers faced earlier in their lives when attempting to obtain higher education.[5] Overall, these results suggest that Black households face more likelihood of being FI even after obtaining a higher education degree, or that some of the different characteristics of Black and White households obtaining higher education may constitute barriers to achieving lower FI.

We present PPFI by poverty status strata in Figure 3 and Appendix S3. We find that, across age groups, Black households in poverty are the least food secure and White households out of poverty are consistently the most food secure. The results suggest that moving households out of poverty has benefits for both Black and White households; however, the benefit for White households is larger. For instance, we find the largest gaps in PPFI between poor and nonpoor households in the 50–54 age cohort: about 80 percent for White households, and 71 percent for Black households. In the oldest age cohort, the PPFI for poor White households is not statistically different than non-poor Black households, indicating a steep decline in PPFI for poor White households from 50 to 54 years of age.

Households that own a home have much lower PPFI than households not owning a home, for Black and White households alike (Figure 4, Appendix S4). However, for most age cohorts, we fail to find a statistical difference between the PPFI of Black homeowners and White households that do not own a home. In the oldest two cohorts, Black homeowners are significantly more likely to be FI than White households that do not own a home. This suggests that the

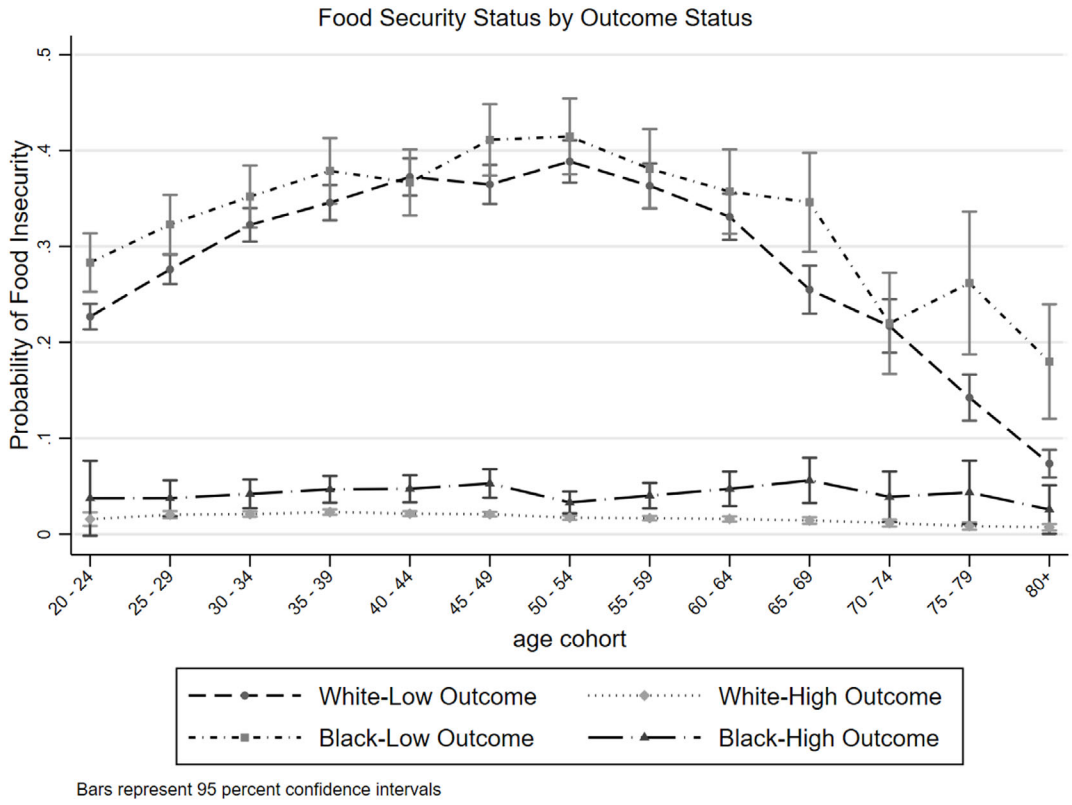

FIGURE 5 Predicted probability of food insecurity (PPFI) of Black and White households by age cohorts: Stratified samples by outcome status. Low outcome represents households that are below the poverty line, have a lower education status, and do not own a home. High outcome represents households that are above the poverty line, have a higher education status, and own a home.

ameliorating effect on FI of wealth via home ownership may be more limited for Black households.

Finally, we repeat the analysis with a sample of households stratified by low and high outcome—that is by nonpoverty, homeownership, and education levels combined (Figure 5, Appendix S5). We fail to reject equivalence between the PPFI of Black and White low-outcome households across nearly all age cohorts. High-outcome Black households have significantly lower PPFI than low-outcome Black households, yet they show larger PPFI than high-outcome White households across most age cohorts, except the two youngest, and the three oldest age cohorts. The reduction in PPFI is consistently greater for White households than Black households. For example, in the 50–54 age cohort, Black households with high outcomes have a 92 percent lower PPFI compared with low outcomes, whereas high outcomes White households in that same age cohort show a 96 percent lower PPFI compared with low outcomes. Thus, even though belonging to a subsample of high-outcome households is characterized by lower PPFIs in both the cases of White and Black households, the PPFI gap between high and low outcomes White households is much more marked. This is consistent with the findings of Feagin (1995) and Kessler et al. (1999) that middle-class Black households are more likely to perceive discrimination as working-class Blacks.

TABLE 5 Marginal effects of education level on food insecurity probability for Black and White households: Full sample and poverty strata

Strata	Degree		Black	White	H_0: $\beta^{Black} = \beta^{White}$
	Associate		−0.043 ***	−0.018 ***	Reject
			(0.006)	(0.001)	
	Bachelor		−0.084 ***	−0.040 ***	Reject
			(0.006)	(0.001)	
	Advanced		−0.099 ***	−0.047 ***	Reject
	Degree		(0.007)	(0.001)	
Poverty	Associate	Poor	−0.052 ***	−0.048 ***	Fail to Reject
Status			(0.012)	(0.004)	
		Nonpoor	−0.043 ***	−0.018 ***	Reject
			(0.006)	(0.001)	
		H_0: $\beta^{Poor} = \beta^{Nonpoor}$	Fail to Reject	Reject	
	Bachelor	Poor	−0.121 ***	−0.110 ***	Fail to Reject
			(0.012)	(0.004)	
		Nonpoor	−0.067 ***	−0.035 ***	Reject
			(0.005)	(0.001)	
		H_0: $\beta^{Poor} = \beta^{Nonpoor}$	Reject	Reject Fail to Reject	
	Advanced	Poor	−0.088 ***	−0.126 ***	Fail to Reject
	Degree		(0.022)	(0.005)	
		Nonpoor	−0.084 ***	−0.039 ***	Reject
			(0.005)	(0.001)	
		H_0: $\beta^{Poor} = \beta^{Nonpoor}$	Fail to Reject	Reject	

Note: Estimates are average marginal effects. Standard errors in parenthesis. ***, **, and *, represent, respectively, a marginal effect statistically different from 0 at the 1%, 5%, and 10% levels, respectively. H_0: $\beta^{Poo\ r} = \beta^{Nonpoor}$ test's null hypothesis: marginal effect for poor and nonpoor are statistically the same. H_0: $\beta^{Black} = \beta^{White}$ test's null hypothesis: marginal effect for Black and White statistically are the same.

Next, we report the estimated marginal effects of higher education degrees for Black and White households, for the full sample and by poverty strata (Table 5). The marginal effects of education by other outcome strata (home ownership and overall outcome levels) show the same patterns as those by poverty strata and are omitted for brevity. Having a higher education degree is, in all cases, associated with lower probability of FI. However, the estimated marginal effects of having an associate, bachelor, or an advanced degree show varying magnitudes by race. For example, having an associate degree is associated with −4.3 percent probability of FI for Black households compared with −1.8 percent probability for White households. Similarly, having a bachelor's degree is associated with −8.4 percent probability for Black households and − 4.0 percent for Whites; an advanced degree, −9.9 percent for Black households and − 4.7 percent for Whites.

The relationship between education and FI by poverty status presents a more nuanced picture. For poor Black households, having an advanced degree is associated with more than 1.69 times lower probability of being FI than having an associate degree, with magnitudes of −8.8

percent and −5.2 percent, respectively. Having a bachelor's degree is associated with a 2.3 times lower probability of being FI than having an associate degree. For poor White households, the more education, the larger the associated reduction in FI. For example, an associate degree is associated with a 4.8 percent lower probability of being FI, a bachelor's degree 11 percent, and an advanced degree 12.6 percent.

Poor White households experience a greater reduction in FI associated with education than non-poor White households, for all degrees. However, we are only able to find a similar relationship for Black households with a bachelor's degree and we fail to reject equivalence between the reduction in FI between poor and non-poor Black households with an associate or advanced degree. This could be due to data limitations—the majority of the sample is White, which may give us a greater ability to detect differences among smaller, White subpopulations than smaller, Black subpopulations.

Overall, the association between education and reduced probability of FI is present for all household types. Promoting higher education may be an important tool for reducing the FI gap between Black and White households, especially if combined with Black households' ability to obtain higher income levels (i.e. to move out of the poor category).

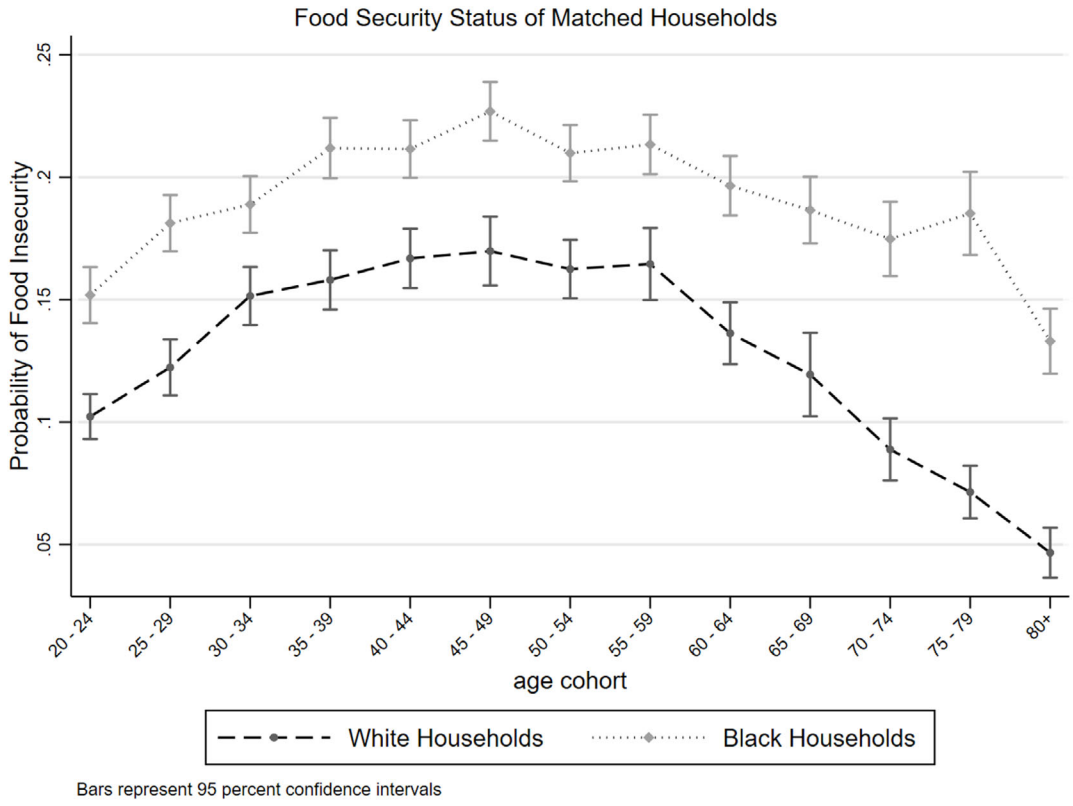

FIGURE 6 Predicted probability of food insecurity (PPFI) of Black and White households by age cohorts—CEM sample

TABLE 6 Estimated marginal effects of age cohorts and higher education degrees on the probability of experiencing FI of Black and White households: CEM sample

	Black	White	$H_0: \beta^{Black} = \beta^{White}$
Age cohorts			
25–29	0.030***	0.020***	Fail to reject
	(0.008)	(0.007)	
30–34	0.038***	0.049***	Fail to reject
	(0.008)	(0.007)	
35–39	0.062***	0.055***	Fail to reject
	(0.008)	(0.007)	
40–44	0.062***	0.064***	Fail to reject
	(0.008)	(0.007)	
45–49	0.077***	0.067***	Fail to reject
	(0.008)	(0.008)	
50–54	0.060***	0.059***	Fail to reject
	(0.008)	(0.007)	
55–59	0.064***	0.061***	Fail to reject
	(0.009)	(0.008)	
60–64	0.046***	0.033***	Fail to reject
	(0.009)	(0.008)	
65–69	0.036**	0.017**	Fail to reject
	(0.010)	(0.010)	
70–74	0.024**	−0.013***	Reject
	(0.010)	(0.008)	
75–79	0.035**	−0.030***	Reject
	(0.011)	(0.008)	
80 and above	−0.020**	−0.055***	Fail to reject
	(0.010)	(0.007)	
Higher Ed degrees			
Associate degree	−0.051***	−0.031***	Fail to reject
	(0.007) ***	(0.006)	
Bachelor's degree	−0.083***	−0.073***	Fail to reject
	(0.006)	(0.005)	
Advanced degree	−0.109***	−0.077***	Reject
	(0.008)	(0.007)	

CEM sample analysis

Although our matched sample has fewer observations, it is more balanced across observable characteristics and there is a common support between Black and White households.

Effectively, this allows us to analyze FI between Black and White households that are statistically comparable in each age cohort. Several key results stand out.

First, even though the Black and White households in this sample are matched on many observable characteristics, Black households are consistently more likely to be food insecure than their White counterparts (Figure 6; Appendix S6). Also, the PPFI gap widens from middle-aged cohorts to the oldest cohorts, which may reflect effects of historical racial injustice. That is, older Black households may have had limited or restricted access to resources and opportunities earlier in their lives that may have allowed them to flourish during retirement similarly to White households. This is highly relevant as older households can face greater physical challenges heading into retirement, even as their disposable income tends to become fixed (Berning et al., 2022).

Table 6 includes average marginal effects for age cohorts and higher education levels estimated using the CEM sample. Most of the age cohort variables generating statistically different marginal effects across Black and White households in the full sample (see Table 4) generate average marginal effects that are *not* statistically different across Black and White households in the CEM sample. Interestingly, the 45–50 age cohort marginal effects, showing the largest difference between Black and White households, no longer appear statistically different for the two race groups. Among the higher education degree indicators, the effect of having an associate degree is not statistically different between the two groups, which differs from what was found using the full sample and across poverty strata (Table 5).

Overall, these results suggest that after matching households some of the systematic differences between Black and White households, which may be driving the gap in FI across the two groups, are no longer as significant. Yet, Black households still show higher PPFI than White households, suggesting that unobservable drivers of FI may be contributing to these disparities. This explanation is even more likely given that several of the estimated marginal effects are not statistically different across Black and White households in the matched sample. There is ample evidence that factors unobservable in the CPS data—like job opportunities, medical access, and healthcare—are meaningfully different for households of different racial compositions (Bertrand & Mullainathan, 2004; Pager & Shepherd, 2008; Williams & Wyatt, 2015). This could suggest a variety of other factors may be contributing to racial FI disparities, and it could be particularly marked in households that experienced the formation of their careers and the foundation of their wealth before and during the Civil Rights Era.

DISCUSSION

Our results confirm that the differences in FI between Black and White households persist across age groups, subsamples, and even after controlling for key observable factors that influence FI. Several reasons may be behind our findings. For example, unequal access to food may contribute to disparities in FI between Black and White households. Myers and Painter (2017) who find that Blacks and Latinos are significantly more food insecure than Whites even when socioeconomic status is held constant, note that residents from Black neighborhoods may have to travel farther away to reach a grocery store compared with residents from predominantly White neighborhoods. As other research finds that presence of food outlets such as grocery stores (Bonanno & Li, 2015) and supercenters (Courtemanche et al., 2019) can reduce the probability of FI, structural interventions to improve the environment where Black households shop may be an avenue to reduce FI disparities between Black and White households.

Our results indicate also that Black homeowners have a lower PPFI than Black households not owning a home. However, some age cohorts of Black homeowners have the same PPFI, and in some cases significantly higher PPFI, than White households not owning a home. This result may be since low-income homeowners, particularly Black ones, may be at higher risk of experiencing low liquidity (Carroll & Cohen-Kristiansen, 2021), which may result in trade-offs between purchasing enough food and affording mortgage payments. As the PPFI homeownership gap narrows for White household across age cohorts (See Figure 4), the gap persists longer and does not narrow as much for Black households. This could indicate some unobserved mechanisms making homeownership a less valuable strategy for Black households compared with Whites in terms of FI.

Overall, negative outcomes may be the result of factors outside the control of individuals, some of them being intergenerational. For example, Chetty et al. (2020) find persistent income disparities across generations, and that Black households have higher (lower) rates of downward (upward) mobility compared with White households. They also find that differences in parental marital status, education, and wealth explain little of the Black–White income gap, but that once parental income is controlled for, Black males in their adulthood experienced lower income than Whites. Aizer and Currie (2014) show that a mother's poor health behaviors, harmful environmental factors, poor access to health care, and poor nutrition conditions during the prenatal period affect both the health of newborns and health outcomes later in their life. Studying the racial FI gap as an outcome of intergenerational decision-making may shed light on some of the mechanisms behind its persistency.

One of the challenges of our analysis is that we can only estimate wealth via home ownership and have no estimates for intergenerational transfers of wealth. Given that we observe White households become far less FI as they get older than Black households, this could suggest that wealth transfers are occurring for White households at larger extent than for Black households. Whereas Black households that have been historically penalized in their opportunity of accumulating wealth may not be benefitting from this phenomenon, future research may provide greater insight into this issue.

CONCLUSIONS

We use 19 years of CPS-FSS data to investigate the probability of FI for Black and White households accounting for heterogeneity in age, poverty level, education, and homeownership (as a proxy for wealth). We find consistently that Black households have higher PPFIs relative to White households. Those differences persist even for Black households with equal levels of achievement in education, income, wealth, or all three factors.

Such results could indicate that policies ameliorating individual households' conditions (i.e., poverty relief programs, education incentives, and homeownership programs) may help mitigating FI in Black and White households alike. At the same time, such policies may be inadequate to eliminate the racial FI gap. Additional research is needed to understand whether other unobserved factors (e.g., structural or institutional) may contribute to the persistency of the FI gap across age groups, poverty status, education level, and household wealth. To that point, survey methods that can identify race-specific drivers of FI could be informative.

Another concern is that throughout our analyses we find that Black households exhibit much greater variation in PPFI at each age cohort than White households. This suggests that investments to mitigate FI in Black households (e.g., education, poverty reduction, etc.) may also exhibit greater uncertainty of outcomes. Further, we find that White households typically show

greater resilience with respect to FI in older age cohorts, whereas older Black households do not see the same level of reductions in FI in older age cohorts. This could indicate a need to focus on greater support for elderly Black households or to identify additional challenges they may face.

ENDNOTES

[1] Structural racism refers to "the totality of ways, in which societies foster racial discrimination, via mutually reinforcing inequitable systems (e.g., housing, employment, earnings, benefits, credit, media, health care, criminal justice, etc.)" (Bailey et al., 2017).

[2] In our sample, over 84 percent report race as white only and over 9.9 percent report race as black only. The next highest category, American Indian/Aleut/Eskimo, is 1.08 percent of the sample.

[3] The poverty level varies by household size, geography, and year. Per the US Government, the poverty guidelines for a household of four in the 48 contiguous states in 2020 was: $26,200 (https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines/prior-hhs-poverty-guidelines-federal-register-references/2020-poverty-guidelines).

[4] Although homeownership can proxy for the accumulation of wealth particularly for low-income households (Wainer & Zabel, 2020), there are limitations. See Carroll and Cohen-Kristiansen (2021) for a discussion.

[5] Future research should consider this limitation when investigating the relationship between education and FI in households with older household heads.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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