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FEATURED ARTICLE

Food insecurity and time use in elderly vs. non-elderly: An exploratory analysis

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Abstract

In the US, elderly households are more food secure than younger households. A possible explanation is that increased time availability enables elderly households to adopt strategies to improve their food security. Using time use data, we find elderly households spend more time in meal preparation and eating time than younger households. Creating a matched dataset of household time use and food security, we find that meal preparation and eating time have a small contribution to differences in food insecurity between older and younger households. However, these relationships are heterogeneous depending upon marital status and age cohort of the household head.

KEYWORDS
elderly, food insecurity, time-use

JEL CLASSIFICATION
J14, I32

In the US, official statistics show that elderly households are less food insecure than younger ones, and that older seniors are less food insecure than younger seniors (Nord, 2003; Coleman-Jensen et al 2012; Ziliak & Gundersen, 2011; Strickhouser et al., 2014). Despite the low rates of food insecurity (FI) among the elderly, as the Baby Boom generation ages, there is growing concern that the rate of FI among the elderly will increase (Gualtieri & Donley, 2016). In fact, from

2001 to 2016, the share of seniors experiencing marginal food security, low food security, and very low food security increased by 27%, 45%, and 100%, respectively (Ziliak & Gundersen, 2018). Such increases in FI may create a major public health challenge if they continue, as FI is associated with poorer health outcomes for the elderly (Gundersen & Ziliak, 2021). Understanding the behaviors of elderly households can help identify opportunities and risks associated with managing elderly FI. The focus of this study is to examine how elderly households invest time in food production and how this is related to the incidence of FI.

People who spend more money on food tend to be less food insecure (Coleman-Jensen et al., 2016) as greater household income generally increases food access and decreases FI (Nord, 2014). As such, one would expect elderly households to face greater challenges with FI as they often have more limited income. However, even though food expenditures decline with retirement, Hurst (2008) finds that food consumption remains relatively unchanged. Hurst attributes this phenomenon largely to retirees spending more time on food production activities, such as preparing meals and shopping, than non-retirees. Aguiar and Hurst (2005) explain how retired households substitute time for money to maintain both the quality and quantity of food they consume. Further, Aguiar and Hurst (2007) show that elderly households increase their shopping time to obtain lower prices for identical products. Hamrick et al (2011) also report that individuals over 65 spend more time on eating and drinking than those in younger age groups. Even though monetary resources become tighter, retired household have more time to engage in activities that can improve their health, including investing in their meal preparations (Godard, 2016).

At the same time, as households get older it typically becomes more challenging to engage in physical activities (Strickhouser et al., 2014). If elderly households become less mobile, they may become less able to engage in activities that reduce their FI. Lee and Frongillo Jr (2001) found that functional impairments in the elderly were significantly related to FI. To exacerbate this problem, retired households with limited income may not be able to substitute away from producing their own meals by paying others to produce meals for them. Older households may also have fewer incentives to invest in the quality of their diet as their income from pension and retirement benefits are not dependent on their health status (Godard, 2016). As a result, we might expect a decline in diet quality during retirement. Finally, retired households may face greater depression and social isolation resulting in less investment in food production activities.

To examine FI and food production in elderly households, we analyze 16 years (2003–2018) of two survey datasets collected by the Bureau of Labor Statistics. Specifically, we use the Current Population Survey's Food Security Supplement (CPS-FSS) and the American Time Use Survey (ATUS). The CPS-FSS includes an eighteen-item questionnaire that classifies respondent households' level of FI, whereas the ATUS provides a 24-h diary of all activities by survey respondents, including activities related to food acquisition and production. Using these data sets, we make two primary contributions.

First, we examine how FI and time used in food production activities change with household age, dividing household into thirteen 5 years age cohorts (from 20 to 85+ years of age) based upon the age of the household head, separating further the data by marital status of the household head (married vs. single). The existing literature on elderly FI provides discrete comparisons between elderly and non-elderly, or above and below 70. Our analysis reveals a gradual decrease in FI over age cohorts older than 45–49 years of age. Furthermore, we find married households to be significantly more food secure than single households across all age cohorts. As FI incidence declines in older age cohorts, we also observe that time spent in meal preparation and eating steadily increase. However, within

a given age cohort neither eating time nor meal preparation is associated with differences in FI probability. Contrary to previous findings, we find no significant difference in time spent shopping for food across age cohorts.

Second, we evaluate how time investments in food production activities are associated with FI for households above and below different age cutoffs using the Kitagawa-Oaxaca-Blinder decomposition approach. Our goal is to explain how the allocation of time to food production and the returns to such efforts contribute to the difference in the probability of experiencing FI across age groups. We find that while time spent on meal preparation and, to a lesser extent, time spent eating, are related to the gap in FI between older and younger households, the contribution of food production activities to the gap in FI is small compared to other attributes such as age or employment status. Furthermore, our results seem to depend upon how we define older households, suggesting that factors explaining the gap in FI across age groups may change as households get older.

The results of this study highlight how elderly households use greater amounts of time in food production activities than younger households. Substituting time for expenditures can be a valuable strategy for mitigating FI; however, relying on activities which have a physical component (e.g., meal preparation) or require cognitive capabilities, can become a less effective strategy as households get older. While our results should not be interpreted as causal, they suggest that some types of investments in food production are associated with greater FI, which could indicate that some households are restricted in how they can allocate their time and expenditures.

DATA

We combine two data sets from the Bureau of Labor Statistics. The Current Population Survey's Food Security Supplement (CPS-FSS) from 2003 to 2018, and the American Time Use Survey (ATUS) from 2004 to 2019. We obtained both data sets from the Integrated Public Use Microdata Series - IPUMS (Flood et al., 2020; Hofferth et al., 2020) at the University of Minnesota.

The CPS-FSS includes an eighteen-item questionnaire that classifies respondents' level of food security as: food secure, low food secure, and very low food secure (Coleman-Jensen et al., 2021) along with socio-demographic characteristics of the respondents and their households. We only use responses from a household head or their spouse to create a binary indicator identifying food insecure households by grouping those reporting low and very low food security status. The ATUS provides a 24-h diary of time spent performing different activities by one survey respondent per household, including activities related to food acquisition and meal production. We focus on four activities: meal preparation, grocery shopping, purchasing food (not groceries), and eating time.

The number of CPS-FSS respondents ranges from 87 to 115 thousand households each year, whereas the ATUS respondents range from 6 to 10 thousand households. A number roughly between 2 to 4 thousand households appear in both surveys each year for a total sample of 53,491 matched households. Because of the timing of the surveys (the CPS-FSS takes place in December, whereas the ATUS takes place the following year), we match responses to the FSS surveys in year t with responses to ATUS in year $t + 1$. In the matched sample, we retain respondents who identify as either a household head or their spouse to focus on household decision makers.

There are two key challenges with using the ATUS data for our study. First, the ATUS reports time use for the survey respondent only, and no information is available for the other members of the households. Although this is not a major problem for single households, for households with married couples who share some of the food preparation responsibilities, spousal time use is likely to be a significant factor to consider. To impute time-use behavior of non-survey respondent spouses we follow a two-step approach similar to You and Davis (2019). First, for married households, we estimate the probability of a survey respondent i engaging in food production activity j on day d, using data from the respondents r such that: $Pr^r\left(FP_{ijd}>0|X^r,D;\theta^r\right)$, where FP is time spent in the food production activity j, X is a set of covariates, and D indicates the day of the week.[1] Second, we predict non-zero time spent on activities by the survey respondents for each day: $E^r\left(FP_{ijd}|FP_{ijd}>0,X^r,D;\theta^r\right)$. We estimate this as a conditional exponential model. Importantly, our predictions of $Pr^r(.)$ and $E^r(.)$ are gender specific. Then, using predicted values from our respondents $(\widehat{\theta}^r)$ we predict non-respondent spousal time use using their covariates (X^s) as: $E^s\left(FP_{ijd}|X^s,D;\widehat{\theta}^r\right)=Pr^r\left(FP_{ijd}>0|X^s,D;\widehat{\theta}^r\right)\times E^r\left(FP_{ijd}|FP_{ijd}>0,X^s,D;\widehat{\theta}^r\right)$

The second issue is that respondents only report time use for one day of the week. As such, when a respondent reports no time spent on an activity, it is impossible to know whether they do not perform the activity at all, or if they did not perform that activity on the day they were surveyed. An example is grocery shopping: while most people shop for groceries, they do not necessarily shop every day.[2] We use the observed time use of survey respondents over each weekday to impute time use for the other unobserved six days of the week for the other households. We perform this imputation separately for married and single households. Specifically, day-specific imputed food production activity time is calculated as: $E^r\left(FP_{ijd}|X^r,D=d;\widehat{\theta}^r\right)=Pr^r\left(FP_{ijd}>0|X^r,D=d;\widehat{\theta}^r\right)\times E^r\left(FP_{ijd}|FP_{ijd}>0,X^r,D=d;\widehat{\theta}^r\right)$. We do this for all unobserved days of the week. We then sum observed and predicted time use for all the days of the week to provide a weekly estimate of the time allocated to food production activities.

In Table 1 we compare the ATUS, CPS-FSS, and matched sample (ages 18–85+)[3] statistics to determine whether the different samples are statistically similar, or if they differ systematically in terms of observed characteristics, which may lead to biases in the statistical analyses performed.[4] Even though both the CPS-FSS and ATUS are designed to be representative of the US population, the matched data set does not have prescribed weight to make the data representative. Thus, summary statistics for the matched sample are not obtained using any population weights.

The composition of the three data sets appears relatively similar, and each highlights relevant differences between married and single households (including divorced and widowed). Average age is similar across all samples, except single households in ATUS which are younger. Married respondents are more likely to be male, whereas single respondents are more likely to be female. The presence of children, family size and racial and ethnic percentages are similar across all groups, as is the share of retired households. Educational attainment and income levels follow similar patterns, and most households live in metro areas. The shares of food insecure households and households below the poverty line in the CPS-FSS samples are similar to those in the matched samples (both married and single households). Time spent on food production activities is also relatively similar between the matched sample and the ATUS sample. Further, average time spent eating is relatively similar to the values provided by Hamrick et al (2011). Households in the matched sample (both single and married) spend more time grocery and non-grocery shopping than overall ATUS respondents.[5]

TABLE 1 Summary statistics by data source and marital status

Variable	CPS-FSS sample		Matched sample		ATUS sample	
	Married	Single	Married	Single	Married	Single
Age	50.59	49.53	48.48	53.79	49.96	39.29
Female	0.40	0.59	0.42	0.63	0.50	0.53
Child	0.53	0.27	0.61	0.23	0.45	0.35
Family size	3.13	1.78	3.27	1.53	3.21	2.80
Black	0.08	0.18	0.08	0.20	0.08	0.18
White	0.85	0.76	0.86	0.76	0.86	0.76
Hispanic	0.12	0.12	0.12	0.11	0.14	0.17
Employed	0.66	0.58	0.68	0.56	0.67	0.59
Retired	0.20	0.22	0.17	0.28	0.17	0.13
HS grad	0.44	0.50	0.40	0.48	0.44	0.48
Associates grad	0.10	0.09	0.10	0.10	0.09	0.07
BA grad	0.22	0.18	0.26	0.19	0.22	0.14
Adv degree	0.14	0.09	0.16	0.11	0.10	0.05
Annual income						
No income reported	0.08	0.08	0.06	0.06	0.06	0.06
<$25 k	0.11	0.37	0.10	0.39	0.11	0.28
$25–$60 k	0.30	0.34	0.29	0.36	0.31	0.34
$60–$100 k	0.25	0.13	0.28	0.13	0.26	0.18
>$100 k	0.26	0.08	0.27	0.06	0.26	0.14
Metro	0.83	0.85	0.82	0.82	0.82	0.85
Food insecure	0.08	0.17	0.08	0.16		
Below poverty line	0.19	0.36	0.19	0.39		
WIC	0.00	0.00	0.00	0.00		
SNAP	0.04	0.13	0.04	0.12		
Meal Prep (minutes/week)			441.95	202.61	453.75	144.11
Eat time (minutes/week)			843.21	370.94	832.41	294.48
Groc Shop (minutes/week)			7.71	6.99	7.09	4.86
Non Groc Shop (minutes/week)			1.29	1.21	1.21	1.13
Observations	338,635	325,661	13,384	20,116	65,172	70,186

Note: Data include respondents who identify as head of household or their spouse.
Note: ATUS sample: American Time Use Survey.
Note: CPS-FSS sample: Current Population Survey - Food Security Supplement.
Note: Matched sample: ATUS and CPS-FSS household in both samples.

EMPIRICAL METHODS

We perform two types of analyses to examine the relationships between FI and food production activities (FP) among elderly and non-elderly households. We discuss the methods used for each of these analyses below.

Estimating the FI and FPgap across age groups

We examine how time allocated to FP and FI change across age cohorts by analyzing the data as a repeated cross-section, such that:

$$y_{it} = \alpha + \beta^{W} W_{it} + \beta^{AC} AC_{it} + \beta^{S} S_{it} + \beta^{T} T_{it} + \varepsilon_{it}, \quad (1)$$

where the dependent variable (y) is either a binary indicator variable for FI, or variables representing the *total time* spent per week by household i in year t performing one of four FPs: meal preparation, grocery shopping, non-grocery food shopping, and eating time. The vector W includes household and household head characteristics associated with FI including gender, presence of children, family size, race (black, white), Hispanic, employment status, education (high school, associates, bachelors, Advanced), income categories, and metro/urban location. AC is a vector of thirteen indicator variables capturing whether the household head belongs to a specific five-year age cohort, spanning from age 20 to 85 and older. S_{it} and T_{it} represent, respectively, State-level and year indicator variables controlling for time invariant (state) and place-invariant (year) variation in the outcome variable y. The scalar α and vectors β^{W},β^{AC},β^{S} and β^{T} are parameters to be estimated, and ε_{it} is an error term.

When the dependent variable is FI, we estimate Equation (1) using a logit estimator and then predict the probability of being food insecure for each age cohort. We performed this estimation using the CPS-FSS sample, as well as the matched ATUS+CPS-FSS sample. For each of the four FP dependent variables we estimate Equation (1) using ordinary least squares (OLS) and then predict time use for each age cohort. We perform this estimation on the ATUS sample and the matched sample. For the FI logit regressions, we use the CPS-FSS weights, whereas for the FP regressions we use the ATUS weights. For the matched sample analysis, there are no weights available. We opt to use the FSS weights and adjust our subsampling for the households that participate in both the FSS and ATUS samples.

We plot the predicted FI and FP values against age cohorts to show changes in FI and time use as households get older. To account for different household structures and the effect this has on food production, we separately estimate models for single headed households and married couples.

Decomposing the FI gap across age groups

In the second part of our analysis, we assess whether time spent on FP explains the FI gap between younger and older households. There is no a priori knowledge as of which age cutoff is appropriate for comparing "younger" and "older" households. Retirement age in the US is 62 for early retirement and 67 for people born after 1960, so it is not consistent between households. Further, retirement benefits are scaled according to when you decide to take retirement which could influence time use and household FI. Additionally, in our data, we observe households that retire well before they are eligible for retirement benefits. Age 65 is often used as a cutoff for elderly, but this does not consider heterogeneous household characteristics.

To compare younger and older households, we split each of our single and married subsamples into two mutually exclusive groups based on age using the following cutoff points: 35, 40, 45, 50, 55, 60, 65, and 70. Our analysis then proceeds in three stages: 1) estimate the relationship between time spent on FP and FI for each of the two groups (younger and older

than a given cutoff point); 2) decompose the difference in FI between the two groups into aggregate endowment and coefficient effects; and 3) assess the contribution of the FP covariates to the endowment effect. This last step helps us to contextualize the importance of time spent on food activities to the overall gap in FI observed. We repeat steps (1) through (3) for each of the cutoff ages. For stage 1, we estimate a linear probability model such that:

$$FI_{Git} = \alpha_G + \beta_G^W W_{Git} + \delta_G FP_{Git} + \beta_G^S S_{it} + \beta_G^T T_{it} + \varepsilon_{Git}, \tag{2}$$

where the subscript G designates a specific subgroup using the cutoff points, FP is a vector of variables representing the time used in food production activities, the parameters δ_G capture the association between FP and the probability of being food insecure for each group G, and the other terms are illustrated above.

In stage 2, we use the Kitagawa-Oaxaca-Blinder decomposition approach to decompose the effects estimated in Equation (2).[6] Let W_{Git}, FP_{Git}, S_{it}, and T_{it} belong to Z_G where G = {1,2}, and θ_G is a vector of associated coefficients. The difference in FI between older and younger households can be defined as:

$$E(FI_1) - E(FI_2) = E(Z_1)'\theta_1 - E(Z_2)'\theta_2. \tag{3}$$

Equation (3) can be expanded, and its terms rearranged to arrive at the typical threefold decomposition:

$$E(FI_1) - E(FI_2) = \{E(Z_1) - E(Z_2)\}'\theta_2 + E(Z_2)'(\theta_1 - \theta_2) + \{E(Z_1) - E(Z_2)\}'(\theta_1 - \theta_2). \tag{4}$$

The first term on the right-hand side of Equation (4) captures the part of the difference in FI that is due to group differences in the explanatory variables, also known as the endowment effect. The second term gives the contribution to the differences in the coefficients, also known as the structure or coefficient effect. The third term accounts for the fact that differences in covariates and their relationship with the dependent variable (FI) occur simultaneously and is called the interaction effect.

In our analysis the reference group is older households. The choice of reference group is important and qualitative results may not be invariant to this choice (Fortin et al., 2011). Also, as pointed out by Jones (1983) and others,[7] the use of categorical variables in Z introduces the "omitted group" problem, where, when the choice of the omitted group is arbitrary, the detailed decomposition yields arbitrary results as well. To address this issue, Fortin et al. (2011) recommend choosing omitted groups with the intent of investigating outcomes of economic interest or that can be easily compared to the established literature. To that end, as discussed previously, most of the variables we construct are binary and not categorical, which allows reference to a baseline. However, the arbitrary baseline problem can continue to exist for these variables as well as continuous variables that do not have a natural zero (Fortin et al., 2011; Jann, 2008). Given that, in the three-fold decomposition presented above, the problem does not occur for the endowment effect (Jann, 2008), we present and discuss results only for the endowment effect.[8] We estimate Equation (2) using ordinary least squares. For the decomposition analysis we use the "Oaxaca" package in Stata 16.

RESULTS

Estimates of the gaps in FI and FP across age groups

We estimate Equation (1) and plot the predicted probability of experiencing FI (PPFI) across age cohorts using the weighted CPS-FSS data to describe how FI changes with age. As can be seen in the top panel of Figure 1, the PPFI increases from the 20–24 age cohort until the 40–44. The PPFI then steadily declines until its lowest point at the 85+ age cohort. Dividing the data into households with married and single heads (bottom panel), an important trend emerges. Notably, single households show significantly greater PPFI compared to married households at all age cohorts except the oldest, with the peak occurring around the 40–44 age cohort. Alternatively, the PPFI for married households is relatively stable until the 40–44 age cohort and then shows a downward trend as they age. These figures highlight important differences in how single and married households experience FI. Still, within both single and married households, household with older heads are less susceptible to FI than younger ones. It is important to note that households transition between married and single status. As such, it is not clear if marriage is protective against FI or if individuals who are able to deal with FI effectively are more likely to get or stay married.[9]

We plot age cohort specific predicted FP time use obtained from estimating Equation 1 for each of the four FP variables in Figure 2. The left panel of Figure 2 show that for all households together, predicted time spent on meal preparation increases until the 65–69 age cohort and

FIGURE 1 Food security status by household type using FSS data [Color figure can be viewed at wileyonlinelibrary.com]

then declines slightly. When we divide the sample by marital status however (right panel), we see for both single and married households that predicted time spent on meal preparation increases steadily across age cohorts. Furthermore, married households spend significantly more time on meal preparation than single households—which is to be expected since we measure time-use at the household level.[10]

Looking at all households we find that predicted eating time increases across all age cohorts but declines slightly for households past 70 years of age (Figure 3, left panel). We observe a similar result for married and single households, for both of which we find an increase in predicted eating time across age cohorts (right panel). Again, married households spend more time eating than single households. Interestingly, the *average* of the predicted eating time for both adult members of married households is still larger than single households.[11]

We observe no apparent trends in predicted grocery shopping time (Figure 4) and non-grocery food shopping time (Figure 5) across age cohorts, likely due to the variation of food shopping time in the data. While both types of predicted food shopping times exhibit a slight upward trend after roughly 50 years of age, there is a great amount of variation in the data making differences in means across cohorts not statistically different from one another. Even plotting predicted shopping time obtained using the single households' sample, which is not subject to our imputation methods, there appears to be a large amount of variation in shopping time, preventing us from detecting any trend in predicted food shopping time across age cohorts.

Using the matched household data (i.e., households both in the CPS-FSS and ATUS) we can examine further how time spent on FP is related to FI across age cohorts. To begin we plot meal

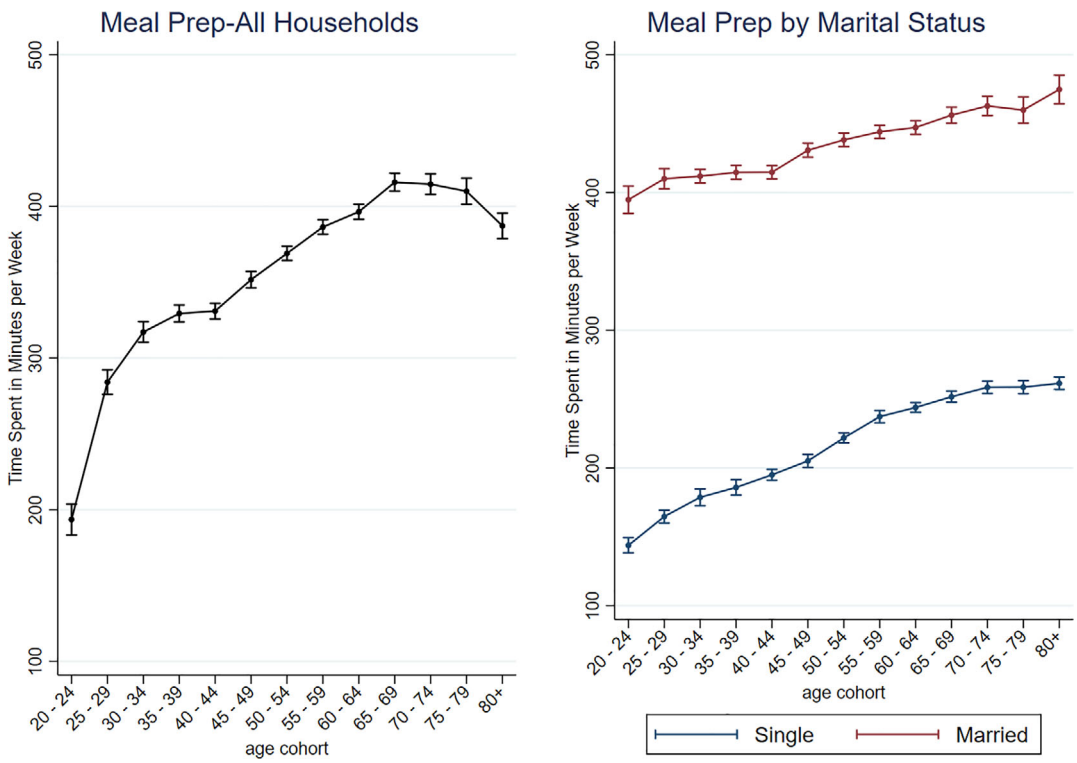

FIGURE 2 Meal preparation time by household type and using ATUS data [Color figure can be viewed at wileyonlinelibrary.com]

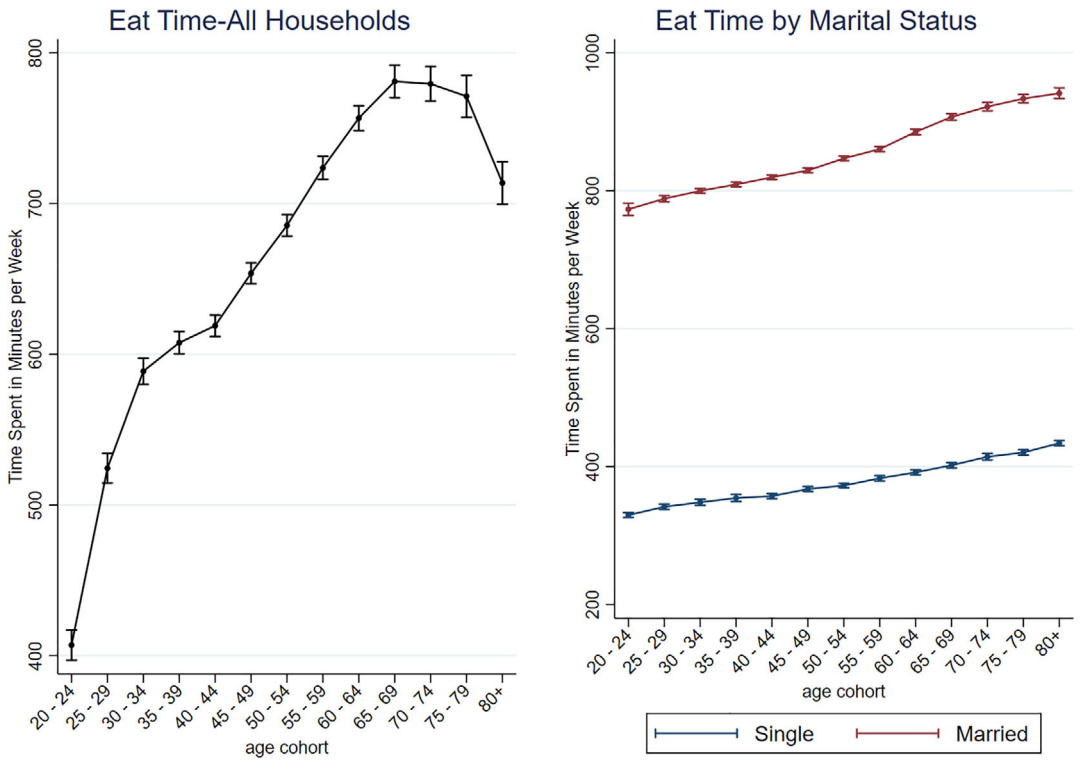

FIGURE 3 Eating time by household type and using ATUS data [Color figure can be viewed at wileyonlinelibrary.com]

prep time in the left panels of Figure 6 for both single and married households. Both show similar trends as the ATUS data, and a gradual increase in time spent on meal preparation across age cohorts. When we subsample the data by FI status for single households (top right panel), we find time spent on meal preparation increasing for both groups across age cohorts. We see, however, no statistically significant difference in meal preparation time between households experiencing and not experiencing FI, except for the 30–34 and 60–64 age cohorts.

Considering married households only (Figure 6, bottom right panel) we observe much greater variability in time spent on meal preparation by households experiencing FI, with no statistical difference in meal prep time spent across any of the age cohorts. But for married households who did not experience FI we observe an increase in meal preparation time across age cohorts. However, at any given age cohort, we do not find statistically significant differences in meal preparation time between food secure and food insecure married households. While this does not necessarily negate potential benefits of spending time on meal preparation for reducing FI, it suggests that the association between meal preparation time and FI might be weak.

With respect to eating time, the matched data reveals similar patterns as the ATUS data for both single and married households (Figure 7, left panels). Specifically, households spend more time eating as they get older. Again, we find no statistical difference in eating time for single food secure and food insecure households (top right panel). For married households, eating time is lower for food insecure households in a few age cohorts, notably the 85+ age cohort (bottom right panel). Like the ATUS data, grocery shopping and non-grocery food shopping

FIGURE 4 Grocery shopping time by household type and using ATUS data [Color figure can be viewed at wileyonlinelibrary.com]

times in the matched sample (not included) show large variation and no consistent patterns across age cohorts, marital, and FI status.

Altogether, this summary analysis highlights several points. First, time spent on meal preparation and eating tends to increase with age for both single and married households. At the same time, we find no change in food shopping time, which contrasts with previous findings. Second, there are meaningful differences in time use of single and married households, although the general trends are similar across age cohorts. Finally, and most relevant to our study, we do not find evidence that time spent on food production varies based on food security status.

Kitagawa-Oaxaca-Blinder decomposition results

We present the results of Kitagawa-Oaxaca-Blinder decomposition of the relationship between time spent on FP and FI.[12] Figure 8 shows the difference in the predicted probability of FI between younger and older households for single households and for married households. On the x-axis, we list the "cutoff" ages used to determine whether households belong to the younger or older households. For example, at cutoff 35, households with a head that are 35 years of age or younger, are defined "younger", whereas those with a head older than 35 are "older." As the cutoff age increases, the gap in PPFI between younger and older single households widens. The difference in the PPFI between younger and older households at a cutoff age of 35 is quite

FIGURE 5 Non grocery food shopping time by household type and using ATUS data [Color figure can be viewed at wileyonlinelibrary.com]

small, about 0.04; however, when the cutoff age is 70, the difference is almost three times as large at 0.11. This provides support for the established finding that the probability of food insecurity decreases as households age (Gundersen & Ziliak, 2018). Interestingly, we do not find similar patterns in the PPFI gap for married households. Marriage may offer protection from FI at all ages thereby reducing the likelihood of being FI across all age cutoffs.

We next show the contribution of the total endowment effect to the difference in PPFI and the effect of selected individual attributes levels (Figure 9).[13] The endowment effect for single households (top left panel) ranges from about 0.12 to about 0.18, depending on the age cutoff point, which over-explains the gap in food insecurity for all age cutoffs. Our primary focus is on the contribution of time use to the difference in PPFI between younger and older households. Although we find that the contribution of time spent preparing meals to the gap in PPFI between younger and older households is statistically significant at all age cutoffs but the two oldest (top right panel), its magnitude is small relative to other covariates, such as being employed and household head age. Interestingly, time spent preparing meals is associated with a reduction in the PPFI gap between groups. We would expect the opposite effect if the additional time spent by older households on meal prep was related to their ability to achieve a lower PPFI. As mentioned previously, the gap in PPFI increases as we increase the age cutoff; however, the magnitude of the endowment effect attributed to time spent preparing meals decreases substantially at the 60 years age cutoff and above for single households.

For married households, the endowment effect (bottom left panel) ranges from about 0.05 to about 0.08 which also over-explains the gap in food insecurity. Looking at specific

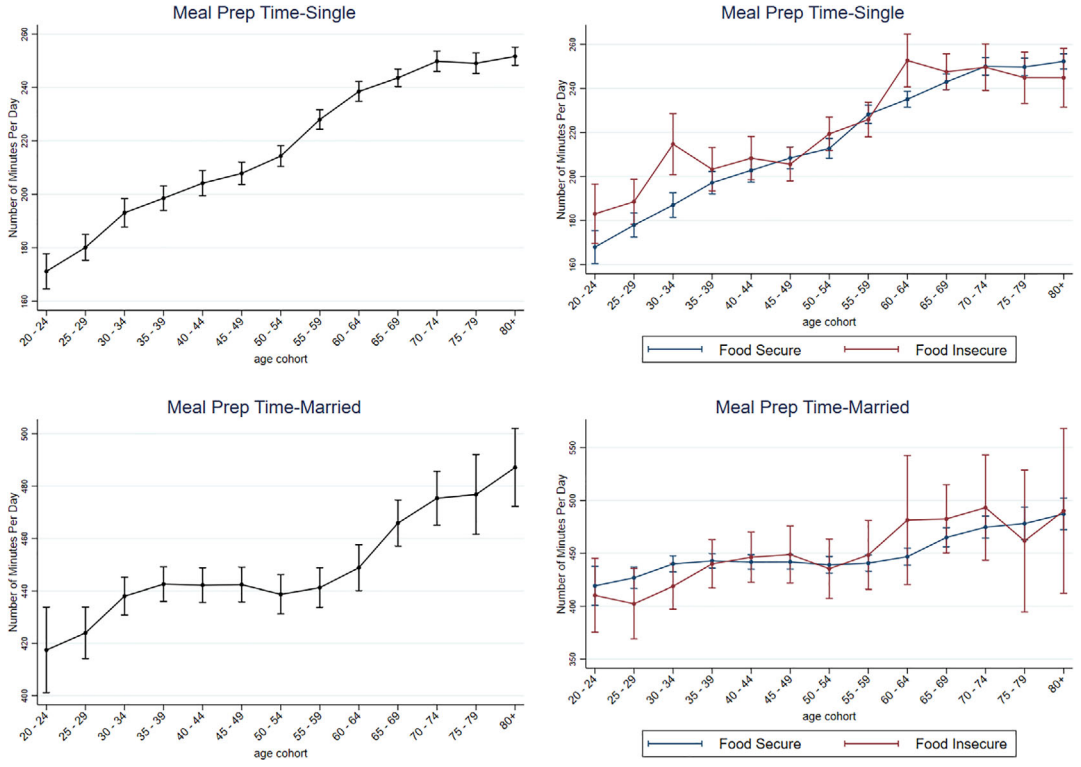

FIGURE 6 Meal preparation time by household type and food security status using matched data [Color figure can be viewed at wileyonlinelibrary.com]

contributions of time use (bottom right panel), we do not find any statistically significant contribution of time spent preparing meals to the PPFI at any age cutoff. This casts further doubt that differences in time spent preparing meals is related to the difference in PPFI between younger and older households. The contribution of time spent eating is statistically significant only for the younger age cutoffs and is too small to be meaningfully related to gaps in PPFI between younger and older households.

We next identify what other factors have a strong relationship with the gap in PPFI between older and younger households.[14] Even though we partition household groups based on age cutoffs, the age of the household head contributes the most to the difference in PPFI between younger and older households for both married and single households. Importantly, this could be due to other factors related with age that are not controlled for in our analysis. For instance, wealth accumulation as households age offers protection from FI (Guo, 2011), but we are unable to explore this further with the FSS data. Differences in income levels do not seem to contribute to the difference in PPFI, which is consistent with the finding that income and food insecurity do not track well together (Gundersen & Ziliak, 2018). Additionally, as individuals age their need for calories decreases (Gundersen & Ziliak, 2018). It may also be that safety net programs are sufficient protection from FI for the elderly with reduced calorie needs (Balistreri, 2022).

Having retired is also significantly related to the PPFI gap between younger and older households at every age cutoff point. The magnitude of the relationship increases up to the age

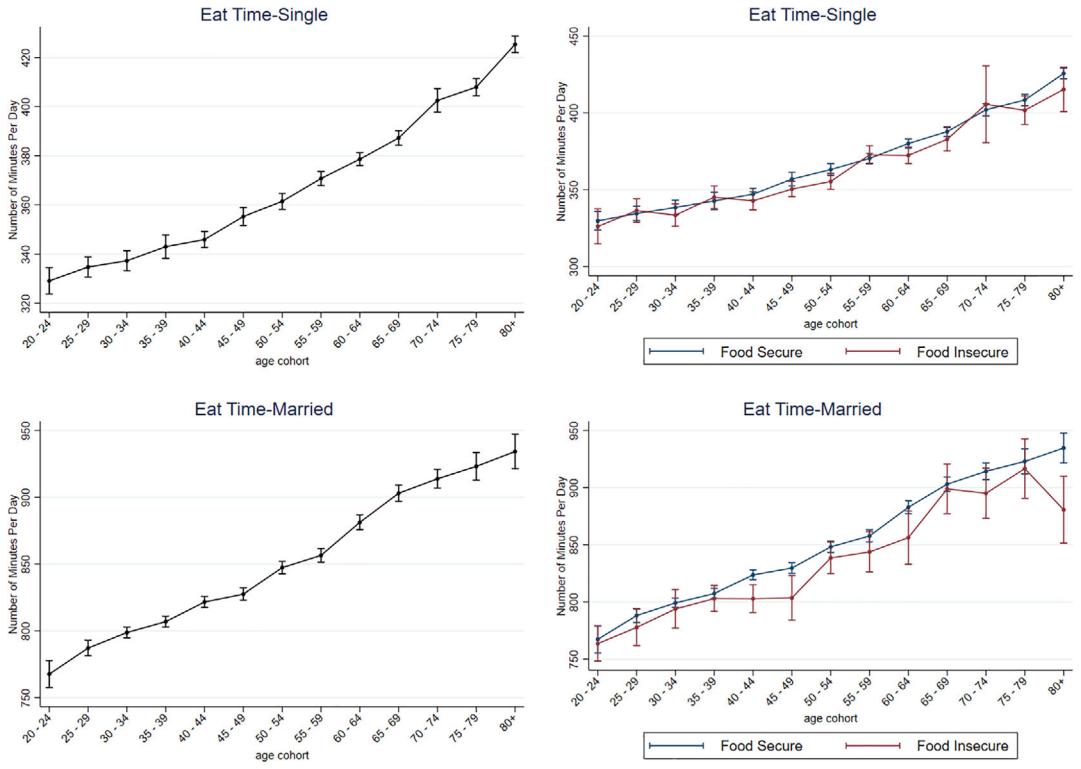

FIGURE 7 Eating time by household type and food security status using matched data [Color figure can be viewed at wileyonlinelibrary.com]

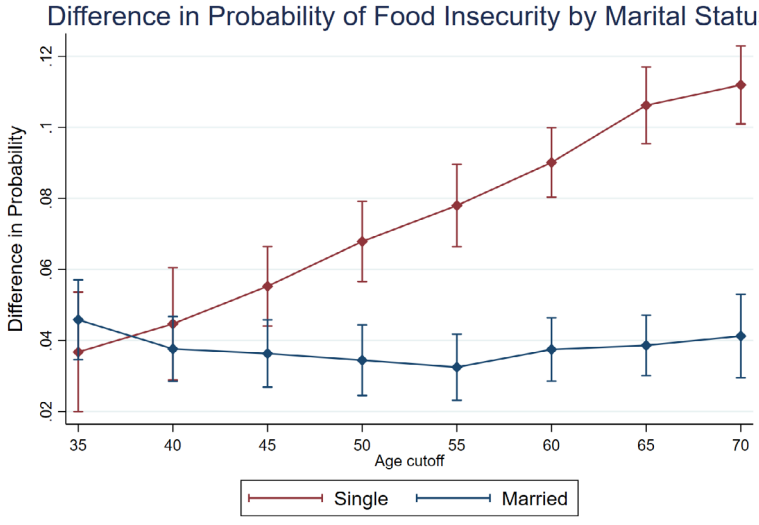

FIGURE 8 Difference in the predicted probability of FI between those above and below the age cutoff for single and married households [Color figure can be viewed at wileyonlinelibrary.com]

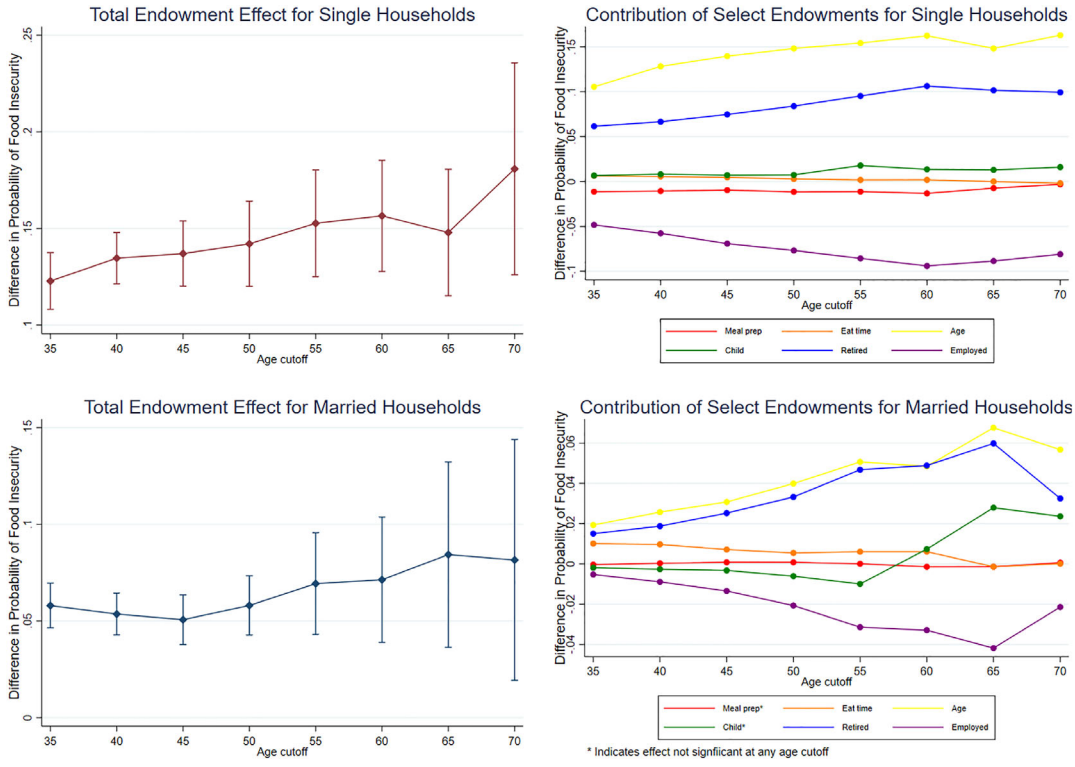

FIGURE 9 Contribution of time on food activities to the endowment effect for single and married households [Color figure can be viewed at wileyonlinelibrary.com]

cutoff of 60; after that it levels off. The reader should be reminded that our analysis is intended to determine what factors are related to the gap in PPFI between younger and older households and not to identify causal links between household attributes and FI. Therefore, our finding may reflect households to be more likely to retire when they do not experience FI, highlighting the potential endogeneity between retirement and FI. Another explanation could also be that households gain more time for FP when they retire (not necessarily as they age, which was discussed above). However, we did not gain any additional insight from interacting the retired binary variable with time spent on FP (results available upon request), consistent with the results presented above.

We observe similar, but opposite, results for being employed. Employment is associated with smaller gaps in PPFI between younger and older households. This relationship is strongest when the cutoff age is 60 for single households, reflecting younger households being more likely to be employed than older households. That the group of younger households has a greater share of employed households versus older households appears to be linked with a smaller difference in PPFIs. This points to the importance of employment in reducing FI, as found by others (Loopstra & Tarasuk, 2013). The relationship of FI among the elderly with time spent on employment versus other activities seems to be a fruitful area of research.

Having a child present in the household contributes to the gap in PPFI between younger and older households for single households, but its contribution is not statistically significant for married households, across all age cutoffs. At a cutoff age of 60, younger single households are more

than five times more likely to have a child present than older ones. As higher levels of food insecurity are associated with households headed by single parents (Gundersen & Ziliak, 2018), older single households may have a lower PPFI relative to younger ones because they are less likely to have children present. This is consistent with the findings that adults may secure the food needs of children before their own (McIntyre et al., 2003; Rose & Oliveira, 1997).

DISCUSSION AND CONCLUSIONS

The purpose of this study is to explore drivers of why older households face lower rates of FI than younger ones (Gundersen & Ziliak, 2018). Whereas much of the previous literature studies FI across specific age categories (i.e., above and below 70), we study the probability of FI across thirteen five-year age cohorts. Doing so, we find the level of FI increases early on until about age 40, then it gradually declines over time. We also examine married and single headed households separately, finding that married households are less food insecure across all age cohorts, except for the 85+ group. This is consistent with previous findings that marriage can convey meaningful benefits such as lower food expenditures (Lazear & Michael, 1980), and scale economies by allowing specialization in the household (Bütikofer and Gerfin 2017; Kimmel and Connelly 2007; Vernon, 2010), thus helping to reduce FI.

It is however unclear why elderly households appear more resilient to FI, even as they face income restrictions in retirement. Since time can be a substitute for other inputs in food production (Becker, 1965; Vickery, 1977), we explored whether time invested in food production changes as household age, and its association with FI probability. We find that time spent on meal production and eating increase significantly for married and single headed households alike across all age cohorts. These results are consistent with Kalenkoski and Hamrick (2013) who find that younger people tend to be more time poor, and that time poverty is associated with less time spent eating and drinking. Presumably, elderly households are on a fixed income and substitute time for money in food production, an explanation consistent with Senia et al. (2017) who find a negative relationship between income and time spent by households on eating and food prep. Also, we find no significant change in food shopping time across age cohorts for both single and married households. The differences in grocery shopping documented by Aguiar and Hurst (2007) may be due to holding the quantity purchased constant whereas the groups in our analysis may purchase dissimilar quantities on average.

Next, we explored whether time spent on food production is associated with differences in FI probability between "older" and "younger" households using a decomposition analysis. Our findings seem to suggest that time spent on food related activities may not have a strong relationship with the gap in PPFI between older and younger households. As pointed out by others, food security does not necessarily imply the ability to adhere to nutritional guidelines. It may be that time spent on meal preparation matters more for meeting nutritional guidelines than food security among the elderly, which appears to be a fruitful area for future research.

Combined with the finding of Aguiar and Hurst that, holding quantity constant, elderly households substitute time spent grocery shopping with prices paid for food, our results suggests that elderly households, on average, may be buying meaningfully different baskets of food. Given that the elderly spend more time on food preparation and presumably purchase less food, it may be that they buy less processed foods (or foods that require more at-home processing) or that they are slower to prepare the same quantity of food as younger households. Investigating differences in food baskets between younger and older households may reveal how elderly

households are able to achieve food security at a higher rate than younger households. Consequently, it may be important to consider that different household structures face different challenges and food assistance programs should proceed accordingly.

We do find other household factors to be associated with lower PPFI. The more likely is the head of a younger household to be employed, the smaller the difference in PPFI between younger and older households, pointing to the importance of employment in reducing FI (Loopstra & Tarasuk, 2013). Investigating the relationship between elderly employment, and time spent on employment versus other activities seems to be a fruitful area of research. While there are extensive demographic differences between food secure and FI households as discussed by Gundersen and Ziliak (2018), demographic differences between older and younger households do not seem to be strongly related to the gap in PPFI, and future work may be better directed to other factors, like those outlined above.

There are important limitations to our analysis as well. First, in parts of our analysis, we use a subset of the CPS-FSS data that includes households answering both the FSS and the ATUS. The CPS does not estimate weights for this subsample. We opted to use CPS weights and adjust for the subsample of respondents that respond to both surveys, although it may have affected the generalizability of our results. Second, we imputed time spent on FP for the non-reported days of the week, which may introduce measurement error into our data. Third, our estimated relationships are non-causal: future research could explore how time used in different activities generates food security. Finally, older households can face significant life changes such as children growing up and moving out of the house, retirement, and disability. The role of other life events should also be examined to further understand how elderly manage FI, such as participating in assisted care living, programs like meal on wheels, or changes in family relationships (Ziliak & Gundersen, 2016).

Overall, our results further show significant differences in married and single households with respect to both FI and time use. Consequently, it may be important to consider that different household structures employ different strategies to deal with FI. Food assistance programs seeking to support elderly households may want to consider these factors.

Finally, elderly households may become more susceptible to injury and may experience limited mobility as they get older. As such, reliance on meal preparation may become a less beneficial approach to mitigating food insecurity. Again, programs seeking to support elderly households may need to consider the physical and mental challenges such households face over time.

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ENDNOTES

[1] For our analysis the vector X includes household and respondent characteristics (respondent gender, age and spouse's age, respondent's and spouse's hours worked, household size, children in the household, respondent's

and spouse's race, and household income), state of residence, a holiday indicator as well as day, month, year of the survey and whether the survey was conducted face to face.

[2] Hamrick et al (2011) report that on any day, only 14 percent of people shopped for groceries.

[3] The CPS-FSS data used in this study top codes age 85 and older as 85 and ages 80–85 as 80.

[4] The CPS-FSS and ATUS samples include household members that responds to each of the two surveys, whereas the matched sample is based on household heads who responded to both the ATUS and CPS-FSS surveys.

[5] As pointed out by an anonymous reviewer, some household members may face physical or cognitive difficulties that limit their ability to engage in food production activities. This may be especially concerning for elderly households and, in return, could affect the results of our analysis especially for single households, as the data show that married households are less likely to report physical or cognitive difficulties. However, since the CPS began gathering data on physical and cognitive difficulties in 2008, accounting for these difficulties directly in our analyses would have reduced our sample size by roughly 30 percent. To determine whether excluding these factors may lead to biased results, we performed some of our analyses using subsamples including only households where the household heads did not report any challenges. The results obtained using these subsamples are briefly illustrated in footnotes throughout the Results section.

[6] It is possible that time spent on FP explains the probability of being FI for each group, and yet fail to explain the gap in FI between the two groups; that could occur, for instance, if the groups have a similar amount of time and use the same technology to prepare food.

[7] We thank an anonymous reviewer for suggesting the inclusion of this important reference.

[8] Coefficient effects are available in the appendix.

[9] We estimated equation 1 also excluding households whose head reported mental or physical challenges. The overall patterns in PPFI did not change, showing only a slight downward shift in the magnitude of the PPFI across age cohorts. Detailed results are available upon request.

[10] We also obtained values of predicted meal preparation time using samples where we excluded households reporting mental of physical challenges. As in the case of the PPFI, we only observed a slight downward shift in the magnitude of the predicted time use compared to the main results.

[11] This figure is not included for brevity but is available upon request.

[12] The complete set of results are provided in the Appendix. Per the discussion in the methods, the results appear robust to the reference group chosen. Appendices A1 – A4 show the younger households as the reference group. Appendices A5 – A8 show the older households as the reference group.

[13] Tables of complete results are available in the Appendix.

[14] Complete results are shown in the Appendix

REFERENCES

Aguiar, Mark, and Erik Hurst. 2005. "Consumption Versus Expenditure." *Journal of Political Economy* 113(5): 919–48.

Aguiar, Mark, and Erik Hurst. 2007. "Life-Cycle Prices and Production." *American Economic Review* 97(5): 1533–59.

Balistreri, Kelly Stamper. 2022. "Older Adults and the Food Security Infrastructure." *Applied Economic Perspectives and Policy* 1–18. https://doi.org/10.1002/aepp.13238.

Becker, Gary S. 1965. "A Theory of the Allocation of Time." *The Economic Journal* 75(299): 493–517.

Bütikofer, Aline, and Michael Gerfin. 2017. "The Economies of Scale of Living Together and how they Are Shared: Estimates Based on a Collective Household Model." *Review of Economics of the Household* 15(2): 433–53.

Coleman-Jensen, A., Rabbitt, M., Gregory, C., & Singh, A. Household Food Security in the United States in 2015, ERR-215 (Washington, DC: US Department of Agriculture, Economic Research Service, September 2016).

Coleman-Jensen, A., Rabbitt, M., Gregory, C., & Singh, A. Household Food Security in the United States in 2020, ERR-298 (Washington, DC: US Department of Agriculture, Economic Research Service, September 2021).

Coleman-Jensen, A., Mark, N., Margaret, A., & Steven, C. Household Food Security in the United States in 2011, ERR-141. US: Department of Agriculture, Economic Research Service, September. 2012.

Flood, S., M. King, R. Rodgers, S. Ruggles, and J. R. Warren. 2020. *Integrated Public Use Microdata Series, Current Population Survey: Version 7.0 [Dataset]*. Minneapolis, MN: IPUMS. https://doi.org/10.18128/D030.V7.0.

Fortin, Nicole, Thomas Lemieux, and Sergio Firpo. "Decomposition Methods in Economics." In *Handbook of labor economics*, vol. 4, pp. 1–102. Elsevier, 2011.

Godard, Mathilde. 2016. "Gaining Weight through Retirement? Results from the SHARE Survey." *Journal of Health Economics* 45: 27–46.

Gualtieri, Marie C., and Amy M. Donley. 2016. "Senior Hunger: The Importance of Quality Assessment Tools in Determining Need." *Journal of Applied Social Science* 10(1): 8–21.

Gundersen, Craig, and James P. Ziliak. 2018. "Food Insecurity Research in the United States: Where we Have Been and where we Need to Go." *Applied Economic Perspectives and Policy* 40(1): 119–35.

Gundersen, Craig, and James P. Ziliak. "The Health Consequences of Hunger among Adults Age 50–59 in the United States: Evidence from the 1999–2016 NHANES." (2021).

Guo, Baorong. 2011. "Household Assets and Food Security: Evidence from the Survey of Program Dynamics." *Journal of Family and Economic Issues* 32(1): 98–110.

Hamrick, K.S., Margaret, A., Joanne, G., David, H., and Ket, M. 2011. "How much time do Americans spend on food?" No. 1476-2019-2786.

Hofferth, S.L., Flood, S.M., Sobek, M., and Backman, D. (2020). American Time Use Survey Data Extract Builder: Version 2.8 [Dataset]. College Park, MD: University of Maryland and Minneapolis, MN: IPUMS. https://doi.org/10.18128/D060.V2.8

Hurst, Erik. The Retirement of a Consumption Puzzle. No. w13789. National Bureau of Economic Research, 2008.

Jann, Ben. 2008. "The Blinder–Oaxaca decomposition for linear regression models." *The Stata Journal* 8(4): 453–79.

Jones, Frank Lancaster. 1983. "On Decomposing the Wage Gap: A Critical Comment on Blinder's Method." *The Journal of Human Resources* 18(1): 126–30.

Kalenkoski, Charlene M., and Karen S. Hamrick. 2013. "How Does Time Poverty Affect Behavior? A Look at Eating and Physical Activity." *Applied Economic Perspectives and Policy* 35(1): 89–105.

Lazear, E. P., and R. T. Michael. 1980. "Family Size and the Distribution of Real per Capita Income." *The American Economic Review* 70(1): 91–107.

Lee, Jung Sun, and Edward A. Frongillo Jr. 2001. "Factors Associated with Food Insecurity among US Elderly Persons: Importance of Functional Impairments." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 56(2): S94–9.

Loopstra, Rachel, and Valerie Tarasuk. 2013. "Severity of Household Food Insecurity Is Sensitive to Change in Household Income and Employment Status among Low-Income Families." *The Journal of Nutrition* 143(8): 1316–23.

McIntyre, Lynn, N. Theresa Glanville, Kim D. Raine, Jutta B. Dayle, Bonnie Anderson, and Noreen Battaglia. 2003. "Do Low-Income Lone Mothers Compromise their Nutrition to Feed their Children?" *CMAJ* 168(6): 686–91.

Nord, Mark. 2003. "Measuring the Food Security of Elderly Persons." *Family Economics and Nutrition Review* 15 (1): 33–46.

Nord, Mark. 2014. "What Have we Learned from Two Decades of Research on Household Food Security?" *Public Health Nutrition* 17(1): 2–4.

Rose, Donald, and Victor Oliveira. 1997. "Nutrient Intakes of Individuals from Food-Insufficient Households in the United States." *American Journal of Public Health* 87(12): 1956–61.

Senia, Mark C., Helen H. Jensen, and Oleksandr Zhylyevskyy. 2017. "Time in Eating and Food Preparation among Single Adults." *Review of Economics of the Household* 15(2): 399–432.

Strickhouser, Sara, James D. Wright, and Amy M. Donley. 2014. "Food Insecurity among Older Adults." *AARP Foundation*: 1–127.

Vernon, Victoria. 2010. "Marriage: For Love, for Money... and for Time?" *Review of Economics of the Household* 8 (4): 433–57.

Vickery, Clair. 1977. "The Time-Poor: A New Look at Poverty." *Journal of Human Resources* 12(1): 27–48.

You, Wen, and George C. Davis. 2019. "Estimating Dual Headed Time in Food Production with Implications for SNAP Benefit Adequacy." *Review of Economics of the Household* 17(1): 249–66.

Ziliak, James P., and Craig Gundersen. 2016. "Multigenerational Families and Food Insecurity." *Southern Economic Journal* 82(4): 1147–66.

Ziliak, James P., and Craig Gundersen. "The State of Senior Hunger in America 2016: An Annual Report. National Foundation to End Senior Hunger." (2018)

Ziliak, James Patrick, and Craig Gundersen. 2011. "Food Insecurity among Older Adults: A Report Submitted to AARP Foundation." AARP.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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