

DECONSTRUCTING LIFECYCLE EXPENDITURE

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Abstract

In this paper we revisit two well-known facts regarding lifecycle expenditures. The first is the familiar “hump” shaped lifecycle profile of nondurable expenditures. The second is that cross-household consumption inequality increases steadily throughout the life cycle. We document that the behavior of total nondurables masks surprising heterogeneity in the lifecycle profile of individual consumption sub-components. We find that three categories (food, nondurable transportation, and clothing) account for both the entire decline in mean expenditure post-middle age and a substantial amount of the increase in cross sectional dispersion over the life cycle. All other nondurable categories we study show no decline in mean expenditure over the life cycle nor do they show an increase in cross sectional dispersion over the life cycle. We provide evidence that the categories driving life cycle consumption are either inputs into market work (clothing and transportation) or are amenable to home production (food). Changes in the opportunity cost of time will cause movements in expenditures on such goods even if there is no change to lifetime resources. We then discuss how the patterns documented in the paper suggest that prior inferences from consumption data regarding discount factors, the ability to plan, or the extent of uninsurable risk faced by households are sensitive to the inclusion of these work related expenses and home produced goods. We conclude by showing that work related expenses also account for a substantial portion of the change in consumption inequality that has occurred within the U.S. since 1980.

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1. Introduction

This paper reconsiders two prominent features of life cycle consumption expenditures. The first is the fact that expenditures are “hump” shaped over the life cycle, peaking in middle age and then declining steadily thereafter.¹ The second fact is that cross-sectional consumption inequality increases as individuals age.² Both facts have had tremendous influence on economists’ inferences about household preferences, the income process that households face, and the extent to which public and private insurance markets limit household exposure to risk.

In this paper we revisit these two familiar facts by disaggregating nondurable expenditures into more detailed consumption categories. We show that there is substantial heterogeneity across consumption goods with respect to both the life cycle profile of mean expenditures and the evolution of the cross household variance in expenditures.

Specifically, we first replicate the standard finding that composite nondurable expenditures, controlling for family composition, peak in middle age at a level roughly 30 percent higher than expenditures at 25 or 65. Similarly, we document that the cross-sectional variance in log nondurable expenditure doubles between ages 25 and 75. However, we then document that the decline in nondurable expenditure post-middle age is essentially driven by three categories – food away from home, nondurable transportation, and clothing/personal care (which collectively comprise just over one quarter of our total nondurable expenditure measure). Moreover, these three categories account for a substantial portion of the increase in the cross-sectional variance of expenditures over the lifecycle. All the other components of our composite nondurable measure (housing services, utilities, entertainment, domestic services, charitable giving, etc.) show *no* decline in expenditures after the age of 45 and exhibit little, if any, increase in cross sectional variance over the life cycle.

¹ This literature documenting the hump shaped profile of expenditures is large and extends back nearly 40 years. See, for example, Thurow (1969), Heckman (1974), Carroll and Summers (1991), Attanasio and Weber (1995), Attanasio et al (1999), Angeletos et al (2001), Gourinchas and Parker (2002), and Fernandez-Villaverde and Krueger (2007). The hump shape holds for nondurable expenditures as well as total expenditures and persists after accounting for changes in family size.

² See Deaton and Paxson (1994), Attanasio and Jappelli (2000), Storesletten et al (2004b), Heathcote et al (2005), and Guvenen (2007).

Canonical models of consumption emphasize movements in uninsurable permanent income as key to both the “hump” shape and the increase in cross-sectional dispersion.³ Models based solely on fluctuations in financial resources predict that categories with larger income elasticities should display greater increases in cross-sectional dispersion and more pronounced hump shapes. However, the disaggregated data show no such pattern. For example, households increase spending on relative luxuries such as entertainment and charitable giving after middle age while simultaneously reducing spending on food, clothing, and transportation. Similarly, the cross-sectional dispersion in the former categories all show declines over the life cycle.

The data do, however, support a prominent role for expenses that are closely linked to a households’ opportunity cost of time. These categories consist of clothing and transportation, which can be categorized as being inputs into market labor supply, as well as food away from home, which is amenable to home production. As the opportunity cost of time falls over the lifecycle and, consequently, some households reduce their attachment to the labor force, expenditures on such “work related” categories should fall, even if there is no change in lifetime resources or preferences. Such work related expenses account for the entire decline in nondurable expenditures after middle age, coincident with the peak in market labor supply for the average household. Moreover, while inequality in composite nondurables increases throughout the life cycle, doubling between age 25 and 75, inequality in nondurable expenditure excluding food and work related expenses increases by only 8 percentage points, with nearly all of the increase occurring prior to the age of 46 or after the age of 68.

To gain more insight into the importance of clothing, nondurable transportation, and food away from home as being work related, we perform a number of additional exercises. First, we document that the decline in expenditure on food away from home after middle age is associated with a decline in the frequency with which individuals patronize fast food establishments or cafeterias, with no indication that individuals reduce their visits to restaurants with table service, consistent with the hypothesis that life cycle variation in expenditures on food away from home is driven by work related meals.

³ See the discussion in Section 5 for details.

Second, we analyze time diaries and show that there is a large decline in time spent commuting to work after the age of 50. However, time spent on non-work related traveling *increases* slightly over the second half of the lifecycle. To the extent that transportation expenditures are proportional to transportation time, these results imply that the decline in transportation expenses is due entirely to a decline in work related transportation. Lastly, we estimate demand systems and document that controlling for labor supply eliminates nearly all the post-middle-age relative decline in spending on clothing and food away from home, and much of the decline in transportation.

The patterns documented in this paper argue for a reassessment of the mapping of consumption to uninsurable permanent income. In particular, the patterns of “core” nondurable expenditures (which we define as nondurable expenditures excluding work related expenses) suggests that cross-household consumption inequality increases much less than suggested by total nondurables and is essentially constant for households between the ages of 45 and 65. This suggests that households face less uninsurable income risk – particularly during middle age - than suggested by total consumption expenditures.⁴

In the final part of the paper, we address the time series patterns for consumption expenditures. We show that work related expenditures are responsible for a large share of the well documented change in consumption inequality since 1980.

2. Data and Empirical Methodology

A. Data

To examine the life cycle profile of expenditure and the life cycle evolution of the cross sectional dispersion, we use data from the Consumer Expenditure Survey (CEX). Specifically, we use the NBER CEX extracts, which includes all waves from 1980 through 2003. We restrict the sample to households who report expenditures in all four quarters of the survey and sum the four responses to calculate an annual expenditure measure. We also restrict the sample to households that record a non-zero annual

⁴ In this sense, this paper complements recent studies that conclude the canonical consumption models have overestimated the extent of uninsurable income risk later in the life cycle. Examples from diverse fields and using different methodology include Keane and Wolpin (1997), Cunha, Heckman, and Navarro (2005), Guvenen (2007), and Huggett, Ventura, and Yaron (2007).

expenditure on six key sub-components of the consumption basket: food, entertainment, transportation, clothing and personal care, utilities, and housing/rent. This latter condition is not overly restrictive, resulting in the exclusion of less than ten percent of the households. When looking at smaller consumption aggregates in isolation (food away from home, domestic services, alcohol and tobacco, and the residual other nondurables), we “bottom code” the expenditure data at one dollar, and then take logs. The online robustness appendix explores how this assumption affects the results.⁵ Lastly, we focus our analysis on households where the head is between the ages of 25 and 75 (inclusive). After imposing these restrictions, our analysis sample contains 53,412 households. Appendix A contains additional details about the construction of the dataset and sample selection.

When examining the life cycle profile of mean expenditures and cross sectional dispersion, we limit our analysis to nondurables excluding health and education expenditures. Our measure of nondurables consists of expenditure on food (both home and away), alcohol, tobacco, clothes and personal care, utilities, domestic services, nondurable transportation, airfare, nondurable entertainment, gambling, business services and charitable giving.⁶ We also examine a broader measure of nondurables which includes housing services, where housing services are calculated as either rent paid (for renters) or the self-reported rental equivalent of the respondent’s house (for home owners). We exclude expenditures on education and health care from the analysis, as the utility (or returns) from consuming these goods vary significantly over the life cycle. Likewise, we exclude all durables aside from housing given the difficulty in creating annual service flow measures for these expenditures.

Our measure of nondurable expenditure plus housing services comprises roughly 75 percent of household annual monetary outlays. The remaining portion of annual outlays can be attributed to expenditures on durables such as automobiles, home furnishing, and large entertainment durables (14 percent); health expenditures (5

⁵ See www.markaguiar.com/aguiarhurst/lifecycle/robustness_appendix.pdf.

⁶ Examples of expenditures that are included in each of the expenditure categories can be found in the data appendix at the end of this paper and the corresponding documentation to the NBER CEX files.

percent); education expenditures (1 percent); and other expenditures which are difficult to classify (5 percent).⁷

B. *Estimating the Life Cycle Profile of Expenditure*

When examining life cycle profiles of mean expenditure and cross sectional dispersion, we adjust all expenditures for cohort and family composition effects. The CEX is a cross-sectional survey and therefore age variation within a single wave represents a mixture of life cycle and cohort effects. Moreover, expenditures are measured at the household level and not the individual level. Household size has a hump shape over the life cycle, primarily resulting from the fact that children enter and then leave the household and from changing marriage and death probabilities over the life cycle. We identify life cycle from cohort variation by using the multiple cross-sections in our sample, and use cross-sectional differences in family composition to identify family composition effects.

Formally, to estimate the life cycle profile of expenditures, we estimate the following regression:

$$\ln(C_{it}^k) = \beta_0 + \beta_{age} Age_{it} + \beta_c Cohort_{it} + \beta_t D_t + \beta_{fs} Family_{it} + \varepsilon_{it}^k \quad (1)$$

where C_{it}^k is expenditure of household i during year t on consumption category k , Age_{it} is a vector of 50 one-year age dummies (for ages 26-75) referring to the age of the household head, $Cohort_{it}$ is a vector of one-year birth cohort dummies (1915 through 1968), D_t is a vector of normalized year dummies to be described below, and $Family_{it}$ is a vector of family structure dummies that include a marital-status dummy, 10 household

⁷ These other categories include, among others, life insurance premiums, college dormitory fees, money allocated to burial plots, union dues, books, lodging expenses away from home, legal services, etc. Some of these categories were excluded because of the classification system introduced by Sabelhaus and Harris when creating the NBER CEX files. For example, the category of “books” includes money spent on books for leisure reading and books purchased for course work. Likewise, the category of “other lodging expenditures” includes both college dormitory expenses as well as vacation rentals. For consistency, we excluded from our analysis any category that included some health or education component. However, in the NBER working paper version of this paper, we examined these categories in greater detail. None of our results are changed if we included these measures in our nondurable expenditure measure. This is not surprising given that they comprise only a small fraction of total household expenditures.

size dummies, and controls for both the number and age of household children aged 21 or under.⁸ Specifically, we control for the number and age of household children by including dummy variables for the number of children in the following age categories: 0-2, 3-5, 6-13, 14-17, and 18-21. Moreover, for the latter two categories, we create separate indicators for male and female children. Our detailed family composition controls allow us to control flexibly for the potential that children of different ages and sex have different consumption needs or preferences. The fact these family composition effects are allowed to differ across expenditure categories accommodates varying degrees of returns to scale across goods.⁹

As is well known, co-linearity prevents the inclusion of a full vector of time dummies in our estimation of (1). In particular, as discussed in Hall (1968), age, year, and cohort effects are identified in repeated cross-sections up to a log linear trend that can be arbitrarily allocated across the three effects. To isolate age profiles, additional assumptions are required. We follow standard practice in the consumption literature (see Deaton 1997) by attributing consumption growth to age and cohort effects, and use year dummies to capture cyclical fluctuations. Specifically, we restrict the year effects to average zero over the long run and to be uncorrelated with trend growth. We do this by imposing the following two restrictions, $\sum_t \beta_t = 0$ and $\sum_t t\beta_t = 0$, on the coefficients of the year dummies. Henceforth, we refer to the year dummies with this restriction on their coefficients as normalized year dummies.¹⁰

We can also account for changes in the relative price of each consumption category by deflating all categories into constant dollars using the relevant CPI product-level deflator, if available. Otherwise, we use the relevant PCE deflator from the National Income Accounts. All data in the paper are expressed in 2000 dollars. We have

⁸ For married households, we use the husband's age. See the data appendix for additional details of how we identify household head in multi-adult households.

⁹ Because of concerns about a potential correlation between family composition and permanent income, we performed many robustness exercises where we control for family composition in different ways. For example, we used a fixed set of equivalent scales to adjust the expenditure data. These results can be found in our online appendix available at: www.markaguilar.com/aguiarhurst/lifecycle/robustness_appendix.pdf. In summary, the main point we are making in this paper is robust to all of these alternative specifications. No matter how we controlled for family size, work related expenses predominantly drive the lifecycle variation in mean expenditure and cross sectional dispersion.

¹⁰ It should be noted that we estimated (1) with only cohort effects (and no time effects) and with one year time dummies (and no cohort effects). The conclusions of the paper are robust to either of alternate specifications.

also done the analysis using the aggregate CPI-U to deflate all categories and found our results were robust to this alternative. In Section 4, we augment our benchmark estimates by controlling explicitly for relative prices and total expenditure. We postpone discussion of that methodology until Section 4.

The coefficients on the age dummies, β_{age} , represent the impact of the life cycle conditional on cohort, year, and family size fixed effects, both of which we allow to vary across expenditure categories. Each of these age coefficients should be interpreted as log deviations from the spending of 25 year olds. These coefficients are the focus of our analysis, as they represent the conditional mean expenditure at each point in the life cycle.

C. *Estimating the Life Cycle Profile of Cross Sectional Expenditure Dispersion*

To estimate the life cycle profile of the cross sectional expenditure dispersion, we start by computing $(\sigma^2)_{it}^k$, the variance of ε_{it}^k (the residuals from (1)) for each age and cohort. We then estimate the following equation:

$$(\sigma^2)_{it}^k = \alpha_0^k + \alpha_{age}^k Age_{it} + \alpha_{cohort}^k Cohort_{it} + \eta_{it}^k . \quad (2)$$

The vector of age coefficients, α_{age}^k , for each consumption category, k , provides our estimates for the evolution of cross sectional variance in expenditures over the life cycle. This method is essentially the same as the one used by Deaton and Paxon (1994).

3. **Life Cycle Expenditure Patterns by Category**

In this section, we document the existence of substantial heterogeneity across different consumption categories with respect to both the life cycle profile of expenditure and the evolution of the cross sectional variance of expenditure over the life cycle.

For context, we first show the trends in life cycle expenditure and life cycle dispersion for our composite nondurable measures. These results are shown in Figures 1a (mean life cycle expenditure profile) and Figure 1b (life cycle profile of cross sectional variance). The solid line in each figure represents the results using nondurable expenditures without housing services. The dotted line represents the results using nondurable expenditures with housing services.

Figure 1a replicates the well-documented profile of nondurable expenditures over the life cycle, with nondurable expenditures excluding housing services peaking in middle age at roughly 25 percent (that is, 0.25 log points) higher than the level of 25 year old expenditure, and then declining by nearly 30 percent over the latter half of the life cycle. Nondurable expenditures inclusive of housing services rises faster early in the life cycle, but then does not decline as significantly later in the life cycle. The gap between the two series represents the life cycle behavior in housing services, which we will discuss on its own in the next sub-section.¹¹ These results are consistent with a large literature documenting the hump shaped profile of nondurable expenditures over the life cycle.

Figure 1b shows the increase over the life cycle of the cross-sectional variance of log nondurable expenditures relative to the variance observed for 25 year olds. The variance for nondurable expenditures with and without housing expenditures for 25 year olds is 0.16 and 0.17, respectively. Between the ages of 25 and 75, the cross sectional variance of nondurable expenditures increase by roughly 15 points, regardless of whether or not housing services are included in the measure of nondurable expenditures. These magnitudes are similar to the results reported by Guvenen (2007) and are consistent with the findings of others that the cross sectional variance of expenditure increases by roughly 100 percent over the life cycle.¹² Additionally, most of the increase comes later in the life cycle (after the age of 40) leading some researchers to conclude that there is a prominent role for permanent income shocks during middle age.

3A. *Life Cycle Profiles of Disaggregated Expenditures*

In Figures 2a and 2b, we plot the life cycle expenditure profiles for the sub-components of our composite nondurable. Specifically, we document the life cycle

¹¹ Yang (2008) documents that the life cycle profile of housing services is different from the life cycle profile of composite nondurable expenditures. She then writes down a model where housing consumption is costly to downsize to explain the differences between housing and nondurable expenditures. As we show below, the life cycle profile of housing looks like the life cycle profile of most other nondurable consumption categories such as entertainment services where fixed costs of adjustment are less relevant.

¹² The increase in inequality over the life cycle is somewhat larger than that documented in Heathcote, Perri, and Violante (2008). This is due to the difference in adjusting for family size. See the online appendix for how different methods for controlling for family size lead to different lifecycle profiles of the cross sectional dispersion in expenditures. However, we wish to stress that the conclusions of this paper with respect to the importance of work related expenditures hold regardless of the different methods of controlling for family size.

spending patterns separately for housing services, utilities, nondurable entertainment, nondurable transportation, food consumed at home, food consumed away from home, alcohol and tobacco, domestic services, clothing and personal care, and a residual “other” category. The “other” nondurable category includes airfare spending, charitable giving, and net gambling receipts. All category specific life cycle spending profiles are estimated using (1) and, as a result, are adjusted for cohort and family composition. Table 1 reports the share of spending out of total nondurable expenditures (both with and without housing) for each of the consumption subcategories.

For expositional purposes, we group the categories by whether or not they decline after middle age. In particular, Figure 2a depicts categories that show no decline over the life cycle, while Figure 2b collects those categories that exhibit declines after middle age. This categorization underscores that not all categories share the prominent “hump” seen in composite nondurables. As reported in Table 1, the strictly non-decreasing categories constitute 54 percent of nondurable expenditures including housing services.

We begin our discussion of Figure 2a with nondurable entertainment spending. Nondurable entertainment consists of such expenditures as cable subscriptions, movie and theatre tickets, country club dues, pet services, etc. It does not include durable expenditures such as television sets and does not include reading material and magazine subscriptions. Of the major categories we examine, nondurable entertainment has the highest cross sectional income elasticity. The average annual expenditure on entertainment totals \$1,260 in year 2000 dollars and accounts for 6 percent of nondurable expenditure excluding housing services (Table 1). Entertainment expenditures (a “luxury” good in the sense that it has a very high cross sectional income elasticity) increase by roughly 70 percent up through the early 40s and then continue to increase. Spending on entertainment increases by 7 percent between 45 and 60 and then increases by an additional 17 percent between the ages of 60 and 68.

As seen in Figure 2a, housing services, utilities, domestic services, and other nondurables exhibit similar life cycle profiles to that displayed by entertainment. All these categories increase significantly between the age of 25 and the age of 45, and then continue to increase steadily over the remainder of the life cycle..

The continuous increases in categories depicted in Figure 2a begs the question of what categories drive the decline in composite nondurable consumption spending after middle age. Figure 2b answers this question. Specifically, food at home spending increases 24 percent between 25 and 45, declines by 7 percent between 45 and 60, and then declines another 4 percent between 60 and 68. The middle age declines in expenditures are even larger for transportation (20 percent between 45 and 60), clothing and personal care (36 percent between 45 and 60), and food away from home (55 percent between 45 and 60). In essence, the decline in nondurable expenditures after middle age is caused by the very large declines in spending on nondurable transportation, clothing, and food away from home. These three categories only comprise 27 percent of average nondurable expenditures with housing services.

The final “declining” category is alcohol and tobacco, which is not included in Figure 2 but is included in Table 1. This category behaves in a manner distinct from the other categories depicted in Figures 2a and 2b. Alcohol and tobacco expenditure falls continuously over the entire life cycle. Moreover, the decline in expenditure is very large: Spending on alcohol and tobacco falls by 1.35 log points between 25 and 45, another 1.69 log points between 45 and 60, and another 1.22 log points between 60 and 68. Even though alcohol and tobacco comprises only 5 percent of composite nondurables, its large decline also contributes significantly to the overall decline in nondurable spending after middle age.

Table 1 summarizes the patterns shown in Figures 2a and 2b. It should be noted that expenditures on all subcategories displayed in Figures 2a and 2b increase over the front half of the life cycle. The difference between the two groups of categories occurs after the mid-40s. Models that predict declines in spending on all consumption goods after middle age (like standard models incorporating household impatience or poor planning) are inconsistent with the disaggregated spending data.

The data reported in Table 1 and Figure 2 also suggest a re-interpretation of the so-called “retirement consumption puzzle,” which refers to the decline in expenditures observed around retirement. In particular, the declines at retirement should be placed in

the context of the broader trend of declining life cycle expenditures after middle age.¹³ The categories that exhibit declining expenditures during the peak retirement years (60-68) are the same categories that exhibit declining expenditures over the second half of the life cycle (after the age of 45).¹⁴ Additionally, there is no evidence that entertainment, housing services, utilities, domestic services, charitable giving, or airline travel declines during the peak retirement years. Taken together, the results cast doubt on the existence of a generic decline in expenditure for all consumption categories around the time of retirement.

3B. Lifecycle Profile of Cross Sectional Dispersion for Disaggregated Categories

The life cycle profiles of mean expenditures by category are mirrored in the life cycle profiles of cross-sectional dispersion. These results are shown in Figures 3a and 3b and are summarized in Table 2. For reference, Table 2 also includes the variance of log consumption at age 25 for each consumption category. As seen in the table, spending on food at home, housing services, and clothing exhibit rather low cross sectional variances at age 25, while alcohol and tobacco, domestic services, and other nondurables exhibit substantial cross sectional variance.

In Figure 3a, we plot the life cycle profile of the cross sectional variance of log expenditure for goods that do not experience any increase in the cross sectional variance over the life cycle. The goods that display no increase in variance are essentially the same goods that do not decline over the back side of the life cycle. The one difference between the categories in Figures 2a and 3a is food at home, which is not included in the former but is included in the latter. Expenditures on food at home do not exhibit an increasing cross sectional variance over the entire life cycle, although the variance does increase slightly after the age of 45. The other categories for which inequality does not increase over the life cycle are housing services, utilities, entertainment, and other nondurable expenditures.

¹³ See Hurst (2007) for a survey of the retirement consumption literature

¹⁴ The fact that declines in expenditures at the time of retirement are limited to food, clothing, and non-durable transportation has also been emphasized by Battistin et al (2006), Hurst (2007) and Aguila et al (2008).

Figure 3b reveals which categories drive the increasing cross sectional variance of log expenditures over the life cycle. These categories include nondurable transportation, clothing and personal care, food away from home, and domestic services. From the figure and the upper panel of Table 2, we see that at the lower end, the variance of log transportation expenditure increases by 26 percentage points (from 0.70 to 1.06). At the upper end, the variance of log expenditures on food away from home more increases by 113 percentage points (from 1.54 to 2.67) while the variance of log expenditure on clothing increases by 0.70 points (from 0.63 to 1.32).

Standard models that focus exclusively on shocks to income to explain life cycle patterns predict that goods with high income elasticities should experience the largest changes in both means and cross-sectional variances over the life cycle. Table 2 and Figures 3 suggest no such pattern. Relative luxuries like entertainment, gambling, charitable giving, and airfare, together with such basics as housing and utilities, show no similarity to the life cycle pattern of composite nondurables. Other than the contribution of the idiosyncratic category of alcohol and tobacco, the prominent features of the composite nondurable category are driven by food away from home, transportation, and clothing/personal care. These latter categories are perhaps best considered as inputs into market work (or, in the case of food, amenable to home production), rather than categories with relatively large income elasticities. In the next section, we explore this premise in more detail.

4. The Importance of Food, Clothing and Transportation in Explaining Life Cycle Profiles

As seen from the discussion in Section 3, there is substantial heterogeneity across consumption categories with respect to both the life cycle profile of mean expenditures and the life cycle profiles of the cross-sectional variance. Leaving aside alcohol and tobacco spending, spending on food away from home, clothing and personal care, and transportation drive both the decline in nondurable spending after middle age and the increase in the cross sectional variance of log non-durable spending over the life cycle. One potential reason why these categories may behave differently over the life cycle is that food is amenable to home production, and clothing and transportation spending are

complements with market work. To the extent that the opportunity cost of time evolves over the life cycle, one would predict changes in spending to occur within these categories given a standard model of household optimization augmented with a home produced good and work related expenses.¹⁵ In this section, we document that much of the life cycle variation in spending on these categories is accounted for by changes in labor supply. We do this in two ways. First, we use alternative data sets to shed light on the nature of expenditure in these categories, with a focus on changes over the life cycle. Second, we estimate a demand system to quantify the impact of labor supply on disaggregated expenditure categories.

Appendix Figures A-1a and A-1b shows the mean and the variance of the life cycle profiles of the labor supply of household heads from the Consumer Expenditure Survey. Our analysis sample for this exercise is identical to the sample used above to document the life cycle consumption profiles. We show two measures of labor supply – the fraction of heads working (solid line) and the normal hours per week worked by the head (dotted line). This latter measure is not conditioned on working. Given that the decline in work hours starts for individuals around the age of 50, it is not surprising to find that work related expenditures (and total nondurable expenditures) should start to decline around the age of 50. Likewise, given the increase in the variance of labor force participation starts around the age of 50s, it is not surprising to see the variance of work related expenditures start to increase around the age of 50.

In this section, we discuss evidence that food is amenable to home production and that clothing and transportation are complements with market work. In doing so, we show that controlling for work status mitigates the decline in work related spending over the latter half of the life cycle.

A. The Home Production of Food

In Aguiar and Hurst (2005, 2007b), we have explored the differences between food expenditures and food intake. Using data from the Continuing Survey of Food Intake of Individuals (CSFII) which measures food intake at the individual level using

¹⁵ See Ghez and Becker (1975) and section 3 of the NBER working paper version of this paper for a formal treatment of this claim.

detailed food diaries (including the quality of food consumed), Aguiar and Hurst (2005) shows that food intake does not decline over the life cycle despite the decline in expenditures after middle age. On the contrary, using the detailed data on the quantity and quality of food consumed, we find that food intake actually increases after middle age.¹⁶

Aguiar and Hurst (2007b) estimate a model of home production and food shopping to explain the differences between food expenditures and food intake. Using data from the American Time Use Survey (ATUS), which measures the amount of time individuals spend preparing meals and shopping for food, and data from the Nielson Homescan Panel, which measures the prices that households pay for a given food good (measured at the level of the universal product code), Aguiar and Hurst (2007b) finds that after middle age individuals allocate more time to preparing meals and shopping for food, and as a result, pay lower prices for constant quality consumption goods. The estimated model of food production and food shopping matches the decline in food at home spending and food away spending. Moreover, like the actual data on food intake, the estimated model predicts rising food intake over the life cycle.

Figure 4 sheds additional light on the margins of substitution that takes place with respect to food spending over the life cycle. Using data from the Continuing Survey of Food Intake of Individuals (CSFII), we measure an individual's propensity to eat away from home at various types of eating establishments. The primary design of the CSFII is to measure food intake via food diaries.¹⁷ The respondents were asked to provide very detailed comments about what they consumed, when they consumed it, and where they purchased it. We construct a variable called "eating away from home" which takes the value of 1 if the respondent reported purchasing food at a restaurant with table service, a restaurant without table service (i.e., establishments like fast food chains), a cafeteria, or a bar/tavern. On average, respondents in the CSFII spend roughly 2.5 days in the sample (some 2 days, others 3 days). For the entire sample, 64 percent of individuals reported

¹⁶ This can be seen from Appendix Figure A1 of the NBER working paper version of Aguiar and Hurst (2005).

¹⁷ The CSFII is a large nationally representative survey of individuals (as opposed to households). As in Aguiar and Hurst (2005), we use the surveys waves conducted in 1989-1991 and 1994-1996 for our analysis. For our analysis, we restricted the sample to 25-75 year olds. Our total sample size used for the results in Figure 4 was 6,615 individuals. See the data appendix for a more detailed description of the CSFII data.

eating away from home at least once during their time in the sample.¹⁸ Of those, 38 percent eat at fast food establishments, 33 percent eat at restaurants with table service, 10 percent eat at cafeterias, and 6 percent eat at bars. The percentages summed to more than 64 percent given some individuals eat at multiple establishments during their time in the sample.

Figure 4 depicts the lifecycle profile of the propensity to eat at the various types of restaurants. As with the expenditure data, we adjust the propensity to eat away from home for changing family composition and all comparisons are made relative to households in their late 20s (25-29). Family controls consist of dummies for household size and four region dummies. The two waves of the CSFII include diaries from 1989—1991 and 1994—1996, which we pool as a single cross section and include year dummies. The overall pattern is similar to expenditures on food away from home, especially as it relates to the declines after middle age. In particular, the propensity to eat away from home falls by nearly 23 percentage points for individuals in their late 60s relative to individuals in their late 40s. However, the entire decline is due to a declining propensity to eat at fast food restaurants and cafeterias. There is no decline in the propensity for individuals to eat at restaurants with table service as they age. This finding is consistent with the premise that the decline in food expenditures reflects households switching towards home production as their opportunity cost declines past middle age. The shift toward home production results in households purchasing fewer meals from fast food establishments and cafeterias, which are close substitutes to home-produced food. The propensity to eat at restaurants with table service, which may provide additional utility beyond the food consumed, remains constant during the latter half of the lifecycle.

¹⁸ This number is approximately consistent with data from the 2003 American Time Use Survey that shows that for a similarly defined sample, 26 percent of individuals eat at a restaurant, fast food establishment or bar on any given day. If eating away from home is i.i.d., this implies that for a 2.5 day interval, 53 percent of individuals would report time spent in a restaurant, fast food establishment or bar.

B. Transportation and Clothing As Work Related Expenses

Spending on clothing and transportation has long been viewed as complements with market work.¹⁹ In order to work, households have to purchase additional clothing and must pay additional transportation costs associated with commuting. Lazear and Michael (1980), among others, have argued that certain costs of employment, such as costs of transportation to work and requisite clothing expenditures be netted out of income when computing welfare calculations across people.

Spending on broad categories such as transportation and clothing likely include components of spending that are associated with work, but this spending is also bundled with non-work spending. For example, transportation expenditures reflect the need to commute to work as well as travel for other (leisure) purposes. While expenditure data does not separately measure costs due to work travel from non-work travel, we can use time diaries from the pooled 2003-2005 American Time Use Survey (ATUS) to gauge the relative importance of each.²⁰ The detailed categories of the ATUS allow us to identify time spent traveling to and from work separately from time spent traveling for other reasons (including going to grocery store, going to visit friends, going to the movies, etc.). The average individual between the ages of 25 and 75 spends 9.0 hours per week traveling, with 2.3 hours per week associated with commuting to and from work. For those that work, work related travel represents roughly one-third of all time spent traveling.

Figure 5 shows the life cycle profile of travel time after adjusting for changing family composition. The family composition controls include a marital status dummy, dummies for household size, and a dummy for whether the household has a child under the age of 5. The life cycle profile is expressed as hours per week deviation from households aged 25-29. Consistent with the decline in transportation expenditures over the life cycle starting for households in their early 50s documented in Figure 2b, the decline in transportation travel time also starts for individuals in their early 50s.

¹⁹ See, for example, Cogan (1981), Nelson (1989), DeWeese and Norton (1991), Banks et al (1998), and Battistin et al (2006).

²⁰ The ATUS is a nationally representative survey which uses time diaries to measure how individuals allocate their day. For a detailed account of the ATUS, see Aguiar and Hurst 2007a. For this analysis, we restrict the sample to only households between the ages of 25 and 75. Our total sample size was 38,876 individuals. See the data appendix for additional details about the ATUS, our sample selection, and our definition of variables.

However, as seen from Figure 5, the entire decline in travel time occurs due to a decline in traveling to and from work. Non-work travel time actually increases over the second half of the life cycle. If transportation expenditures are roughly proportional to transportation time, the data from the time use surveys suggests that the decline in transportation spending over the life cycle stems from the decline in time spent commuting to work. Again, this is consistent with the fact that transportation expenditures, and particularly their fluctuations over the life cycle, have a substantial work related component.

C. *Work Hours and Work Related Spending*

Given the potential importance of work related expenses in driving changes in expenditure over the life cycle, a natural approach would be to directly control for work status when estimating the lifecycle profile of mean expenditures or dispersion. A difficulty with simply adding controls for employment status to regression (1) is the fact that labor supply is closely associated with permanent income. For example, lower wage workers in the time frame of our sample tend to work fewer hours than high wage workers (see Aguiar and Hurst (2007a) and Vandenbroucke (2007)). Absent a panel, controls for labor supply will also proxy for permanent income. However, using the standard tools of demand system analysis, we can explore the effect of labor supply on how expenditure is allocated across different goods, conditional on a given level of total expenditure. That is, by including total expenditure, we can isolate the effect of labor supply from variation in permanent income across households.

Specifically, we estimate the following:

$$s_{it}^k = \omega_0 + \omega_{age} Age_{it} + \omega_c Cohort_{it} + \omega_i D_t + \omega_{fs} Family_{it} + \sum_k \omega_p^k \ln P_t^k + \omega_p \ln P_t + \omega_X \ln X_{it} + \omega_L L_{it} + \varepsilon_{it}^k, \quad (3)$$

where X_{it} is our measure of total nondurable spending and is defined as the sum of spending across all the categories shown in Figures 2a and 2b (i.e., total nondurable spending including housing services and excluding alcohol and tobacco) for household i in period t . s_{it}^k is the share of spending on consumption category k out of X_{it} for household i in period t . By definition, for each household the shares across the different

consumption categories sum to 1. The age, cohort, year, and family status controls are the same as in equation (1). We include as additional controls the log price index of each of our sub-aggregates ($\ln P^k$) as well as the overall price index ($\ln P$). These variables, together with the normalized year dummies, control for changes in relative prices across the consumption categories. We compute the category specific price indices by using the weighted share of the price indices for the goods that comprise the consumption category. Finally, we include a vector of controls describing household labor supply (L). We discuss these controls below.

Given the fact that expenditures on the individual consumption categories are determined simultaneously and the fact that any measurement error in one category will lead to measurement in X , we follow the standard practice of instrumenting X with log total household family income and education dummies.²¹ Our measure of total household family income includes labor and transfer income of both husbands and wives.

Note that equation (3) is a close parallel to the almost ideal demand system (AIDS) of Deaton and Muelbauer (1980), conditioned on work status, family size, cohort, and age. We impose the restriction that the overall price index is given by the CPI-U, but do not impose restrictions related to consumer optimization such as symmetry and homogeneity. The inclusion of work status controls to form a conditional demand system follows the important work of Browning and Meghir (1991) and Blundell et al (1994).

Using (3), we answer two different questions. First, among younger households (those under the age of 50), how is working associated with spending on different consumption goods? If there are work related consumption needs, we would predict that, all else equal, an increase in household labor supply would be positively associated with spending on those categories. By estimating (3), we assess whether transportation spending, clothing spending, and food away from home are positively associated with household labor supply. Second, we use (3) to assess how much of the decline in spending post middle age on work related consumption categories can be attributed to

²¹ Specifically, the instruments consist of log income (where the 217 households with zero income are bottom coded at 1 dollar), a dummy for zero income, income squared, income cubed, and four educational dummies indicating the head's educational attainment (<12, 12, 13-15, 16+).

changes in household labor supply. In particular, we estimate (3) both with and without controls for labor supply and see how the age coefficients change.

The results of the first question are shown in Table 3. To avoid issues of changes in household formation and its effect on labor supply, we restrict our analysis sample to include only married households. Similarly, to avoid the issue of retirement, we restrict our analysis to only those households where the head is 50 years old or younger. This leaves us with a sample of 21,034 households. Specifically, Table 3 shows the results from estimating (3) when our measure of household labor supply (L) consists of two dummy variables; one indicating whether the husband is currently employed and another indicating whether the wife is currently employed.

Table 3 shows that there are only three consumption categories for which the share of spending is positively associated with household labor supply. These three categories are nondurable transportation, food away from home, and clothing. Specifically, the unconditional mean for the share of spending (s) allocated to nondurable transportation is 13 percent. Households where both spouses work spend an additional 1.4 percentage points (or an additional 11% above the average share) on nondurable transportation compared with an otherwise similar household where only the husband works. Having a working wife increase the share spent on food away from home by 8 percent. Both of these differences are statistically significant at the 1 percent level.

Table 3 also shows that there is no positive relationship between the share of spending allocated to any of the other main consumption categories and household employment status. Rather, given the adding up constraint, the share of spending on most of these other consumption categories is negatively related to employment status. Our simple demand system estimates confirm what we discussed above: spending on clothing, nondurable transportation, and food away from home are positively associated with household labor supply.

Figures 6a-6c show the results from our second exercise. In these results, we plot the age coefficients from our estimation of (3) where the sample includes all married households between the ages of 25 and 75 (34,195 households). We focus our attention on the share expenditures allocated to the specific work related categories: transportation (Figure 6a), food away from home (Figure 6b), and clothing (Figure 6c). We then ask

how much of the declining share of spending on these goods post middle age can be explained by changing work status. To do this, we estimate (3) with (dotted line) and without (solid line) work controls.²² As always, each point represents the deviation from age 25, with the units for Figure 6 being share of total nondurable expenditures.

As seen from Figures 6a – 6c, without work status controls, the share of spending allocated to nondurable transportation, food away from home, and clothing falls between the age of 50 and 75 by roughly 3.3 percentage points, 0.7 percentage points, and 2.1 percentage points, respectively. The dashed lines indicate that the inclusion of labor supply controls reduce the post-middle age decline in expenditure shares dramatically. In particular, controlling for the labor supply of both the husband and wife explains essentially all the decline in the share of spending allocated to clothing and personal care and food away from home, and roughly 40 percent of the decline in the share of spending allocated to non-durable transportation.

5. Implications and Related Discussion

A. Three Consumption Sub-Aggregates

The above discussion suggests a natural decomposition of nondurable expenditures. Namely, we consider three sub-aggregates: (i) work related expenses, consisting of clothing/personal care, food away from home, and non-durable transportation; (ii) food consumed at home; and (iii) all other nondurable expenditure categories including housing services but excluding tobacco and alcohol. We refer to this latter measure as “core nondurable” expenditures. This 3-way decomposition simplifies the analysis while retaining the key patterns of the more disaggregated data.²³

²² We found that labor supply has a nonlinear effect on consumption for these different consumption categories, so when we include work status controls, we include a much more extensive set of controls than simply whether or not the husband and wife were employed. Specifically, our work status controls in Figure 6 also include: a vector of 7 dummies indicating the number of weeks worked by husbands during the previous year, a vector of 7 dummies indicating the number of weeks worked by the wife during the previous year, a vector of 9 dummies indicating the number of hours usually worked during the week by the head, and a vector of 9 dummies indicating the number of hours usually worked during the week by the wife.

²³ We break out food consumed at home as a separate category given that it is strongly amenable to home production (see Aguiar and Hurst 2005 and 2007b). Despite the fact that food spending at home declines slightly after middle age, including this category in our measure of core nondurables does not affect the results pertaining to the mean lifecycle profile of spending. However, the fact that the share of food at home out of nondurable expenditures declines over the lifecycle does affect the lifecycle pattern of consumption variance given that food consumed at home has a lower cross sectional variance compared to the cross sectional variance for the rest of nondurable spending.

The mean and cross-sectional variances of these categories are depicted in Figures 7a and 7b, respectively. Table 4 summarizes the life cycle profiles for the three composite consumption goods. In Figure 7a, we see that core nondurables increases sharply up through middle age and then increases steadily thereafter. Work related expenditures, however, fall sharply after middle age.

A striking reflection of our results on consumption inequality is clear in Figure 7b. The cross sectional variance of core nondurable expenditures displays a dramatically different life cycle pattern than does the cross sectional variance of total nondurable expenditures as analyzed by Deaton and Paxson and others, and replicated in Figure 1b above. In particular, up through the age of 65, the cross sectional dispersion in core nondurables increases by approximately 8 points, with nearly all of the increase coming prior to the age of 55. Given that the variance of core nondurables for 25 year olds is 0.28, the cross sectional dispersion of core nondurables increases by less than 30 percent over the life cycle. This is less than a third of the proportional increase in cross sectional variance for total nondurables.

The implication is that essentially all of the increase in cross-sectional variance over the life cycle stems from work related expenses. The sharp increase in inequality in expenditure on work related expenses is clear in Figure 7b. Note in particular that the variance of work related expenses increases significantly after middle age, while core nondurables shows no comparable increase. The cross-sectional variance of total nondurables increases by nearly 10 percentage points between the ages of 45 and 68 (Figure 1b), which represents nearly half of the increase in life cycle dispersion of total nondurables. All of the increase in variance between the ages of 50 and 68 in total nondurables is due to an increase in the variance of work related expenditures (as well as the changing shares of goods over the lifecycle and the associated covariances).

In summary, “core nondurable” expenditure displays a dramatically different lifecycle profile for both the mean and the cross sectional variance than does the standard composite measure of nondurable expenditure. The results indicate that the prominent features of life cycle consumption, particularly after middle age, primarily reflect changes in work related expenditures that move independently of other consumption categories.

B. Re-Interpreting the Existing Literature

There is a large body of work that tries to explain the lifecycle profile of composite nondurable expenditures, without addressing the heterogeneity found in disaggregated consumption categories. For example, some authors have argued that the lifecycle profile represents evidence against the forward-looking consumption “smoothing” behavior implied by permanent income models, particularly since the hump in expenditures tracks the hump in labor income (as documented by Carroll and Summers (1991)). This view interprets expenditure declines in the latter half of the lifecycle as evidence of poor planning. A related literature has developed which also emphasizes imperfect household planning based on the sharp decline in expenditures at the onset of retirement (see, for example, Bernheim, Skinner, and Weinberg 2001). Models of limited commitment to plans (such as Angeletos et al 2001) share the implication that the decline in expenditures late in life is due to insufficient resources. Standard models of poor planning or dynamic inconsistency, however, do not predict that households late in the life cycle reduce some expenditures while simultaneously increasing others. Many of these behavioral models are often focused on less educated, poor, or financially unsophisticated agents. In this regard, we note that we have split our sample by educational attainment and found the patterns documented in this paper hold for both less educated and more educated household heads.

Another literature has combined rational, forward looking agents with incomplete markets. In particular, the hump shaped profile in expenditure reflects optimal behavior if “impatient” households face liquidity constraints combined with a need to self-insure against idiosyncratic income risks (see, for example, Zeldes 1989, Deaton 1991, Carroll 1997, Huggett 1996, Gourinchas and Parker 2002, Storesletten et al 2004a). Households build up a buffer stock of assets early in the lifecycle, generating the increasing expenditure profile found during the first half of the lifecycle. The decline in the latter half of the lifecycle is then attributed to impatience coming to the fore, once households accumulate a sufficient stock of precautionary savings. Similarly, the increase in cross-sectional dispersion of total expenditures has been interpreted as evidence of large, uninsurable idiosyncratic shocks to income.

Such precautionary savings models have been extremely influential, in part due to their ability to explain the prominent features of lifecycle expenditures in a rational agent, incomplete markets framework. Indeed, several important studies have used expenditure profiles to “back out” or verify measures of labor income risk over the lifecycle (see, for example, Deaton and Paxson (1994) as well as more recent papers by Storesletten et al (2004a, 2004b) and Guvenen (2007)). A related literature uses movements in consumption to infer movements in permanent income (see, for example, Blundell and Preston (1998), Aguiar and Gopinath (2007), and Blundell et al. (2008)). Of course, the quality of these measures of income risk depends crucially on the validity of the underlying model of consumption.

Precautionary savings models also have strong predictions for the lifecycle behavior of goods with different income elasticities. The standard precautionary savings model works off the tension between the need to accumulate assets for insurance versus impatience relative to the market interest rate. Relative impatience is necessary to explain the sharp decline in expenditures in the latter half of the lifecycle.²⁴ However, if impatience is the predominant force driving the decline in expenditures over the second half of the lifecycle, then categories of consumption for which there is a high degree of inter-temporal elasticity should decline faster than those with a low degree of substitutability. Given the equivalence between inter-temporal elasticity and income elasticity (see Browning and Crossley 2000), this implies that luxury goods (such as entertainment, gambling, and charity) should decline more in the latter half of the lifecycle than necessities (such as food and transportation).

Note that both the precautionary saving models and the poor planning models place an emphasis on income fluctuations. The poor planning models emphasize deterministic trends in lifecycle labor income. The precautionary savings models emphasize income uncertainty. In particular, the high degree of impatience in the precautionary savings model needed to explain the sharp decline in expenditures late in life must be matched with a commensurately high degree of income uncertainty early in

²⁴ The important role impatience plays in these models is highlighted by the fact that Gourinchas and Parker (2002) are able to obtain a very precise estimate of time preference. As discussed in that paper (p. 73), this reflects the fact that the precautionary savings model’s predictions are extremely sensitive to the discount rate.

the lifecycle. This latter component is necessary to explain why agents save and exhibit an upward profile of expenditure early in the lifecycle, despite the high subjective discount rate. The tight link between income risk and impatience relative to the interest rate is also a familiar feature in incomplete market models with infinitely lived agents (see for example, Huggett 1993 and Aiyagari 1994).

By focusing on the disaggregated data, we documented that the primary movements of expenditures later in the lifecycle are inconsistent with the models that rely exclusively on precautionary savings, myopia, or limited commitment. We should stress, however, that our work does not imply these forces are not at work at all. For example, the increases early in the life cycle may indeed reflect a precautionary savings motive. However, without accounting for the role that work related expenses play, attempts to use total expenditure to back out permanent income risk will be mis-specified.

In a companion paper (Aguilar and Hurst 2009), we study a model with three expenditure categories: work related expenses, food (a home produced good), and an additional (standard) consumption good (akin to our measure of core nondurables).²⁵ We then use actual income data and the lifecycle profiles of mean spending and cross sectional variances for our three expenditure categories to back out 1) the level of household impatience, 2) the permanent shocks to income faced by households at different stages of their lifecycle, and 3) the importance of precautionary saving in explaining aggregate wealth holdings. In our calibrated model, we find that when we model work expenditures directly and match the disaggregated consumption data households are much more patient than previously estimated. We also find that households face less permanent income risk; the estimated variance of the permanent income innovation is cut in half when we match the disaggregated consumption data. Again, the reason that the model generates these results is that core nondurable expenditures are relatively flat post middle age (implying patient consumers) and the

²⁵ The “non-separability” between consumption and work status has been documented by, among others, Browning and Meghir (1991) and Blundell et al (1994), using conditional demand system analysis. Our work complements these studies by arguing that once we strip out work related expenses, mean nondurable expenditures do not decline and there is little increase in cross-sectional inequality after middle age.

cross sectional variance of consumption increases only slightly post middle age (implying that household face less permanent income risk).

6. Disaggregated Consumption and Time Series Implications

The facts documented so far show the importance of disaggregating expenditure data when studying consumption over the life cycle. However, the same points we have emphasized – primarily the importance of home production and work related expenses – may also be relevant when examining time trends in consumption and consumption inequality. The fact that employment status varies over time, whether at low frequencies due to demographic changes or at business cycle frequencies, implies that the corresponding changes in work related expenses will induce movements in aggregated consumption. In this section, we conclude our empirical analysis by examining the evolution of consumption inequality during the last twenty-five years for different consumption categories. In doing so, we show that work related expenses are quantitatively important when examining such time series consumption data.

Over the past two decades, researchers have debated the extent to which changes in consumption inequality have mirrored the well-documented changes in income inequality.²⁶ For example, Krueger and Perri (2004, 2006) use data from the CEX and show that while consumption inequality increased modestly during the 1980s, it has remained roughly unchanged during the 1990s despite the continued rise in income inequality. Slesnick (2001) reaches similar conclusions. Blundell et al. (2002) use the PSID up through 1992 and shows that inequality in food expenditures (including both food at home and food away from home) has been increasing since the late 1970s. Attanasio et al. (2004) use the diary data from the CEX and find that, contrary to Krueger and Perri, U.S. consumption inequality appears to have increased substantially throughout the 1990s.

Motivated by the life cycle facts documented in this paper, we address to what extent any change in consumption inequality is driven by work related expenses rather than core expenditures. While our primary goal is not to reconcile the results of Krueger

²⁶ See Katz and Autor (1999), for example, for a detailed analysis of the growing inequality in wages within the U.S. starting in the late 1970s.

and Perri (2004, 2006) on the one hand with Attanasio et al (2004) on the other, the role of work related expenditures sheds some light on the origin of the difference, a point we discuss at the end of this section.

In Table 5 we show the evolution of consumption inequality as measured by the change in the log variance of consumption between 1981 and 2003.²⁷ In particular, the table reports the change in consumption inequality for four expenditure measures: total nondurable expenditures, core nondurable expenditures, work related expenditures, and food at home expenditures. Each of these categories is as defined above.

We estimate the change in cross sectional variance over time in three ways, associated with the three panels of Table 5. In Panel I, we compute the raw cross-sectional variance of log expenditure in each year and report the change over the 1980s and 1990s by differencing across the respective years. In Panel II we first regress log expenditure on our controls for age, cohort, normalized year, and family composition, as in equation (1). We then compute the variance of the regression residuals for each year and report the differences across years in Panel II. In Panel III, we take the same residuals from Panel II, but compute cross-sectional variances for each age-year pair. We then regress these variances on age and year dummies, and report the difference in the coefficients on the year dummies in Panel III. This last specification controls for the fact that the cross-sectional variance increases with age, particularly for work related expenses, as well as the fact that the cross-sectional variance in work status has a strong age component (figure A2). Given that the average age in the sample has been increasing over the period, these purely age effects may contaminate the differences reported in Panels I and II.

As reported in Table 5, we find that across all specifications, the cross sectional variance of total nondurable expenditures increased between 1981 and 1990 and then continued to increase between 1990 and 2003. The fact that our results differ somewhat from both Krueger and Perri (2005) and Attanasio et al. (2004) can be attributed in part to our use of different controls for family size, a point discussed in the online robustness

²⁷ The sample for Table 5 is identical to the sample used in Figure 1 and Table 1 with one exception -- we exclude 1980 from the sample in Table 6 as this wave was particularly small and is therefore not ideal for anchoring the time series analysis.

appendix. From Table 5, we see that the magnitude of the changes depend on whether or not we control for family size and whether or not we include age effects along with the time effects. Controlling for age in the second stage reduces the estimated increase in the cross sectional variance of expenditure due to the aging of the sample (panel II vs. panel III).

In rows 2-4 of Table 5, we show the change in the cross sectional variance of core nondurable expenditures, work related expenditures, and food at home expenditures between 1981 and 2003. Two results are immediately apparent from Table 5. First, the increase in the variance of log core nondurable expenditures is smaller than the increase in the variance of log total nondurable expenditures. For example, in the results shown in Panel II, which is most similar to the methodology used by others in the literature, the increase in the cross sectional variance of expenditures over the last two decades falls from 8.7 percentage points to 6.8 percentage points when we go from using total nondurables as our measure of expenditures to using core nondurables as our measure of expenditure (a decline of 23%). A similar proportional decline is reported in Panel III.

The second result that is evident from the results shown in Table 5 is that the increase in the cross sectional variance of the log of work related expenses between 1981 and 2003 is much larger than the increase in the cross sectional variance of log core nondurable expenditures. For example, in Panel II, the increase in the log variance of work related expenses is nearly 11 percentage points which is nearly twice the increase in the log variance of core nondurables. It is not surprising that the dispersion of work related expenses increased during this period given that the dispersion in market work hours has increased (Aguiar and Hurst 2007a). The gap between core and work related expenses remains, but is smaller, once we control for age effects in cross-sectional variances (Panel III).

In summary, a few conclusions can be drawn from Table 5. First, as with the lifecycle analysis, the evolution of consumption inequality over time differs by consumption category. Second, the inequality within work related expenditures increased more than the inequality in core nondurables during this period (which also coincided with an increase in the fraction of the population reporting being retired). Third, and

finally, controlling for age effects mitigates the effect of including work related expenses in total nondurables.²⁸

We conclude this section by returning to the different estimates of Krueger and Perri (2004, 2006) and Attanasio et al. (2004). The above results suggest that the source of the disagreement is at least in part due to the fact that the interview data from the CEX (used by Krueger and Perri) cover different goods than the diary data (used by Attanasio et al.). In particular, the diary data of the CEX is weighted toward work related expenses. As reported by Attanasio et al., in the 1999-2001 diary data, 37% of respondents reported zero housing service expenditures (compared to 2% in the interview survey). Likewise, 55% and 26% of diary respondents reported zero expenditures on utilities and non-durable goods and services (which include entertainment services), respectively. The comparable number of respondents who reported zeros in the interview survey for these categories were 7% and 15%. The primary components of our core nondurable measure included housing services, utilities, and nondurable entertainment – the goods that tend to be omitted in the diary data. The diary data, however, tends to accurately measure food at home, food away from home, and nondurable transportation (the level of households reporting zero expenditure on these categories was low and within 4 percentage points of each other across both surveys).

Given the findings in Table 5 and the sample coverage of the two surveys as documented by Attanasio et al., it is reasonable to suspect that the diary data implies larger increases in cross sectional expenditure variance over time than does the interview data because the diary data disproportionately contains work related expenditures.

7. Conclusion

This paper documented that the hump in lifecycle expenditures and the increase in consumption inequality over the life cycle is driven primarily by work related expenses or goods amenable to home production. There is no evidence that the distinctive patterns for the mean and variance of life cycle consumption is more prominent for goods with a

²⁸ It should be noted that change in inequality for total nondurable expenditure is not a simple weighted sum of the change in inequality of core, work related and food expenditures. The difference between the changing inequality in total nondurables and the sum of the changing inequality of the sub-components is also due to covariances across the sub-components as well as the changing share of the sub-components out of total nondurables over time.

high income elasticity, suggesting a force other than uninsurable permanent shocks is also at work. We provide evidence that changing labor supply is a promising candidate.

While the main focus of this paper is on lifecycle movements, the same issue arises in studies of the business cycle (see, for example, Greenwood, Rogerson, and Wright (1995)), and in the evolution of cross sectional expenditure variation over time. The last part of the paper illustrates that modeling work related expenditures is quantitatively important when interpreting changes in inequality over time. Moreover, we note in concluding that an analysis similar to that of Section 6 shows that aggregate work related expenses fall more during recessions than do core nondurable expenditures, and in general work related expenditures display higher volatility at business cycle frequencies. This raises the issue of whether the choice of expenditure aggregate is quantitatively important in assessing the welfare costs of business cycles, a question we leave for future research.

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Table 1: Summary of Change in Expenditure over the Lifecycle by Consumption Category

<i>Disaggregated Consumption Group</i>	<i>Share of Non Durable Expenditure</i>	<i>Share of Non Durable Expenditure with Housing</i>	<i>Log Change Between 25 and 45</i>	<i>Log Change Between 45 and 60</i>	<i>Log Change Between 60 and 68</i>
Decreasing Categories					
Food at Home	0.25	0.17	0.24	-0.07	-0.04
Transportation	0.19	0.13	0.25	-0.20	-0.17
Clothing and Personal Care	0.11	0.08	0.04	-0.36	-0.20
Food Away from Home	0.09	0.06	0.13	-0.55	-0.29
Alcohol and Tobacco	0.05	0.03	-1.35	-1.69	-1.22
Non-Decreasing Categories					
Housing Services		0.33	0.73	0.23	0.14
Utilities	0.17	0.11	0.72	0.28	0.11
Entertainment	0.06	0.04	0.80	0.07	0.17
Other Non-Durable	0.05	0.03	1.44	0.16	0.17
Domestic Services	0.03	0.02	1.52	0.30	0.32
Non Durable Expenditure	1.00	0.67	0.25	-0.13	-0.07
Non Durable Expenditure w/Housing		1.00	0.39	-0.03	-0.01

Note: Table summarizes the life cycle profiles of expenditures for different consumption categories as shown in Figures 2a and 2b. See Figures 2a and 2b for sample description and empirical methodology. In summary, for each category, we regress log expenditures in 2000 dollars on cohort dummies, normalized year dummies, marital status and detailed family composition controls, as well as one year age dummies. See text for definition of each category and the appendix for data sources. The first two columns show the share of spending on the consumption commodity out of total non durable expenditures without housing service (column 1) and with housing services (column 2). The log changes are the difference in the coefficients on the age dummies at the respective ages in each of the last three columns. To reduce noise, we average over three intervals for each difference. Specifically, the change between 25 and 45 represents the average change between the age intervals 25--27 and 44--46; the change between 45 and 60 represents the average change between 44--46 and 59--61; and the change between 60 and 68 represents the average change between 59--61 and 67--69.

Table 2: Dispersion of Expenditure over the Lifecycle by Consumption Category

<i>Disaggregated Consumption Group</i>	<i>Cross-sectional Variance of Log Expenditure at 25</i>	<i>Change Between 25 and 45</i>	<i>Change Between 45 and 60</i>	<i>Change Between 60 and 68</i>	<i>Change Between 25 and 75</i>
<u>Increasing Categories</u>					
Transportation	0.70	-0.14	0.12	0.18	0.26
Clothing and Personal Care	0.63	0.20	0.53	0.14	0.70
Food Away From Home	1.54	0.00	1.27	0.62	1.13
Alcohol and Tobacco	5.80	1.65	2.34	1.34	4.02
Domestic Services	6.82	1.02	1.20	0.70	2.67
<u>Non Increasing Categories</u>					
Housing Services	0.41	-0.07	-0.09	-0.04	-0.14
Utilities	0.89	-0.55	-0.09	-0.06	-0.67
Entertainment	1.29	-0.29	-0.12	-0.14	-0.55
Other Non-Durable	9.57	-0.89	-1.16	-0.23	-2.38
Food at Home	0.41	-0.04	0.02	0.00	-0.02
Non Durable Expenditure	0.17	0.05	0.07	0.03	0.14
Non Durable Expenditure w/Housing	0.16	0.06	0.06	0.03	0.14

Note: Table summarizes the life cycle profiles of expenditures for different consumption categories as shown in Figures 3a and 3b. See Figures 3a and 3b for sample description and empirical methodology. In summary, for each category, we regress log expenditures in 2000 dollars on cohort dummies, normalized year dummies, marital status and detailed family composition controls, as well as one year age dummies. At each age and for each cohort, we compute the standard deviation of the residuals from this regression. The first column is the average standard deviation for age 25, pooling all cohorts. For the remaining columns, we regress the standard deviation on age and cohort dummies, and use the age dummies to report the lifecycle profile. As in Table 1, we use three year age windows to express the differences across ages.

Table 3: The Relationship Between Work Status and Spending, by Consumption Category

<i>Disaggregated Consumption Group</i>	<i>Mean Share Out of Total Nondurable Expenditures</i>	<i>Coefficient on Dummy Variable: Husband Working</i>	<i>Coefficient on Dummy Variable: Wife Working</i>
Transportation	0.13	0.014 (0.002)	0.014 (0.001)
Food Away From Home	0.06	0.008 (0.001)	0.005 (0.001)
Clothing and Personal Care	0.08	0.003 (0.001)	0.001 (0.001)
Housing Services	0.34	-0.009 (0.003)	-0.012 (0.002)
Utilities	0.12	-0.005 (0.001)	-0.003 (0.001)
Entertainment	0.04	0.000 (0.001)	0.000 (0.001)
Food At Home	0.18	-0.016 (0.002)	-0.013 (0.001)

Notes: This table reports the coefficients on dummy variables indicating whether the husband is working (column 3) and/or the wife is working (column 4) in a regression in which the dependent variable is the share of expenditure out of total nondurable spending (including housing services but excluding alcohol and tobacco) allocated to the category indicated in column 1. Each regression includes the standard vector of controls used in Tables 1 and 2, the full set of (log) price indices for each category indicated in column 1 and the overall CPI deflator, and log total nondurable expenditure (see equation 3 in the text). We instrument total nondurable expenditure with a flexible function of total household income and dummies indicating the educational attainment of the head (<12, 12, 13—15, >=16). For the regression analysis, we restrict our sample to include only married households between the ages of 25 and 50 (inclusive), which is a sample of 21,034 households. Standard errors are in parentheses. Column 2 includes the unconditional mean of the share of spending out of total nondurable spending excluding alcohol/tobacco for each of the consumption categories. For this column, we use the full sample of 53,412 households.

Table 4: Summary of Our Composite Measures of Consumption

a. Life Cycle Expenditure: Means

<i>Disaggregated Consumption Group</i>	<i>Share of Non Durable Expenditure with Housing</i>	<i>Log Change Between 25 and 45</i>	<i>Log Change Between 45 and 60</i>	<i>Log Change Between 60 and 75</i>
Core Nondurables	0.56	0.68	0.17	0.20
Food At Home Expenditures	0.18	0.24	-0.07	-0.12
Work Related Expenditures	0.27	0.16	-0.27	-0.30

b. Life Cycle Expenditure: Cross Sectional Variance

<i>Disaggregated Consumption Group</i>	<i>Cross-sectional Variance of Log Expenditure at 25</i>	<i>Percentage Point Change Between 25 and 45</i>	<i>Percentage Point Change Between 45 and 60</i>	<i>Percentage Point Change Between 60 and 75</i>	<i>Percentage Point Change Between 25 and 75</i>
Core Nondurables	0.28	0.03	0.03	0.04	0.08
Food At Home Expenditures	0.41	-0.04	0.02	0.00	-0.02
Work Related Expenditures	0.34	0.05	0.16	0.07	0.24

Note: Table summarizes the life cycle profiles of expenditures for different consumption categories as shown in Figures 7a and 7b. See Figure 7 for sample description and empirical methodology.

Table 5: The Evolution of the Cross Sectional Variance of Log Expenditure Between 1981 and 2003

Log Expenditure Measure	Change in the Cross Sectional Variance of Log Expenditure Over Different Time Ranges								
	I.			II.			III.		
	1981-1990	1990-2003	1981-2003	1981-1990	1990-2003	1981-2003	1981-1990	1990-2003	1981-2003
Log Total Non Durable Expenditures	0.055	0.039	0.094	0.042	0.045	0.087	0.036	0.037	0.073
Log Core Non Durable Expenditures	0.063	0.027	0.090	0.037	0.031	0.068	0.034	0.023	0.058
Log Work Related Expenditures	0.104	0.041	0.145	0.076	0.038	0.114	0.052	0.020	0.072
Log Food at Home Expenditures	-0.047	-0.020	-0.066	-0.005	0.003	-0.002	-0.004	0.000	-0.003
First Stage Controls	None	None	None	Full	Full	Full	Full	Full	Full
Second Stage Controls	None	None	None	None	None	None	Age	Age	Age

Notes: This table shows the change over time in the cross sectional variance of different consumption sub-aggregates. Specifically, log expenditure on the sub-aggregate indicated in column 1 is regressed on a set of controls. In panel I, this first stage is omitted. In panels II and III, the “Full” set of controls in the first stage consist of cohort dummies, normalized year dummies, marital status and detailed family composition controls, as well as one year age dummies. The cross-sectional variance of the residuals from the first stage are used in the second stage regressions. In panels I and II, the variance of the residuals is computed for each year separately, and the elements of the table indicate the difference across respective years in cross-sectional variance. In panel III, the residual variance is computed separately for each year-age cell, and then we regress the variance on a set of year and age dummies. The elements of panel III represent the difference in the coefficients on the year dummies.

Figure 1a: Non Durable Expenditures Over The Lifecycle, With (dashed) and Without (solid) Housing Services

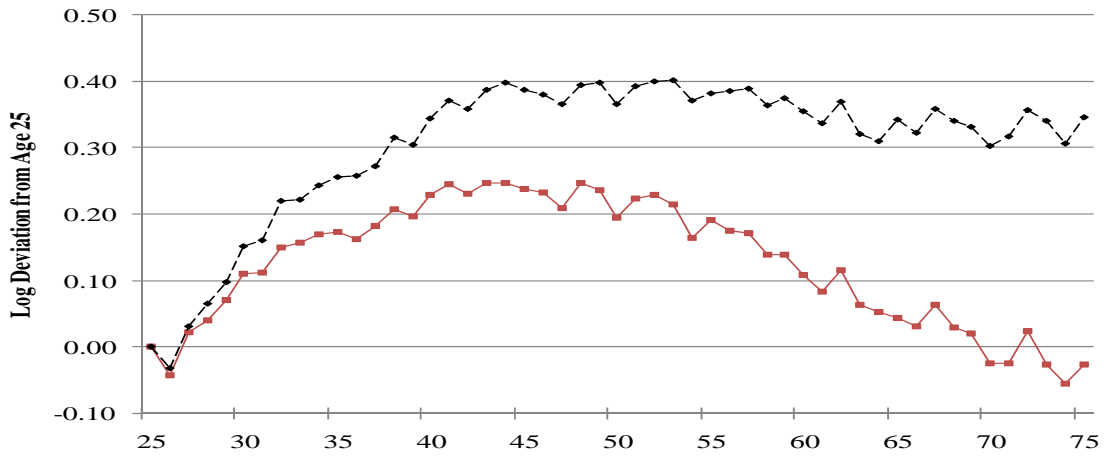
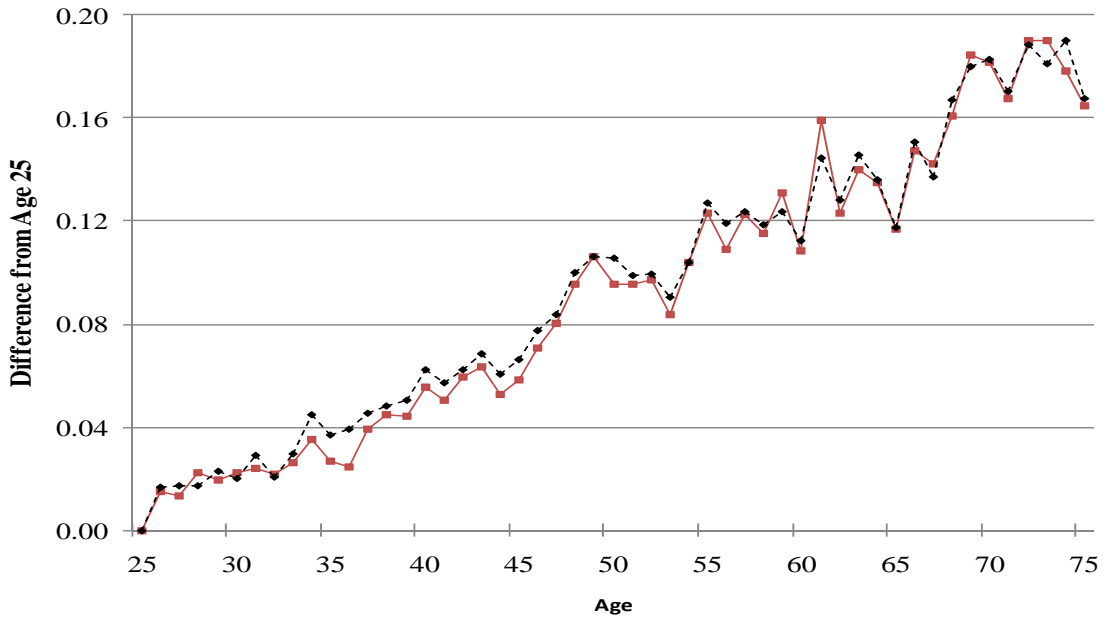


Figure 1b: Cross Sectional Variance of Total Non Durable Expenditure Over the Lifecycle, With (dashed) and Without (solid) Housing Services



Notes: Figure 1a plots mean log expenditure by age conditional on cohort, normalized year, and family status controls. Each point represents the coefficient on the corresponding age dummy from the estimation of equation 1, with age 25 being the omitted group. Figure 1b plots the life cycle profile of the cross-sectional variance of log expenditure, conditional on cohort, year, and family composition controls. Specifically, we compute the cross-sectional variance of the residuals from the first stage regression (equation (1)) for each age-cohort pair, and then remove cohort fixed effects to isolate the life cycle profile of cross-sectional variance (equation (2)). Again, all deviations are from age 25. The solid (dashed) line represents total nondurable expenditures without (with) housing services. The sample size is 53,412 households covering the 1980-2003 waves of the CEX. See data appendix for details on sample construction. All data are weighted to be nationally representative using the CEX core weights. See text for definitions of nondurable and housing service expenditures.

Figure 2a:
Expenditures over the Lifecycle, Categories that Do Not Decline After Middle Age

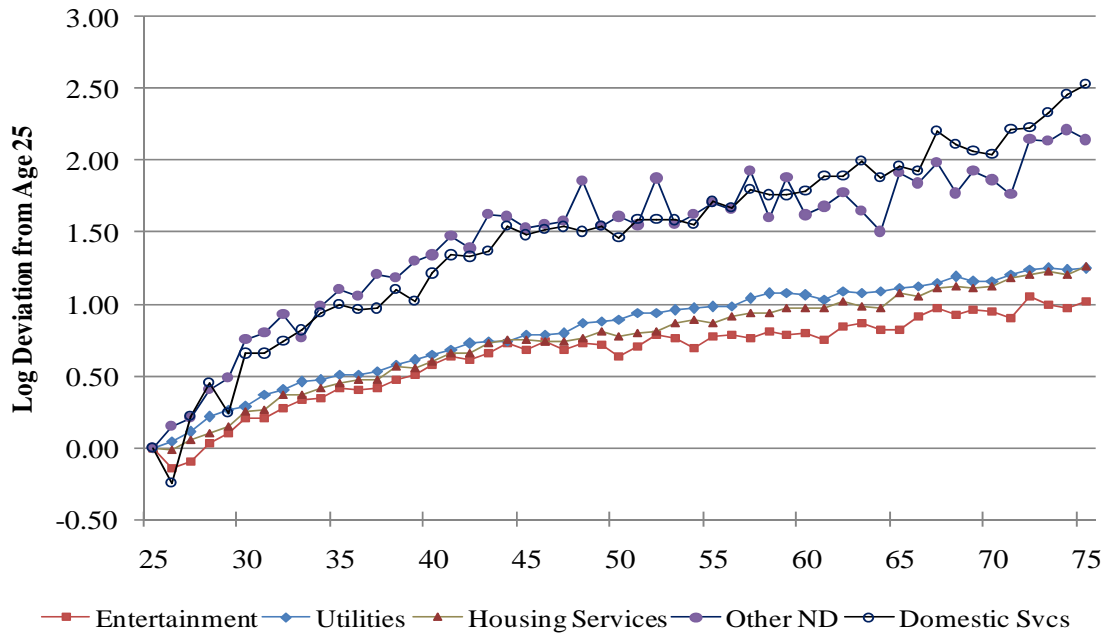
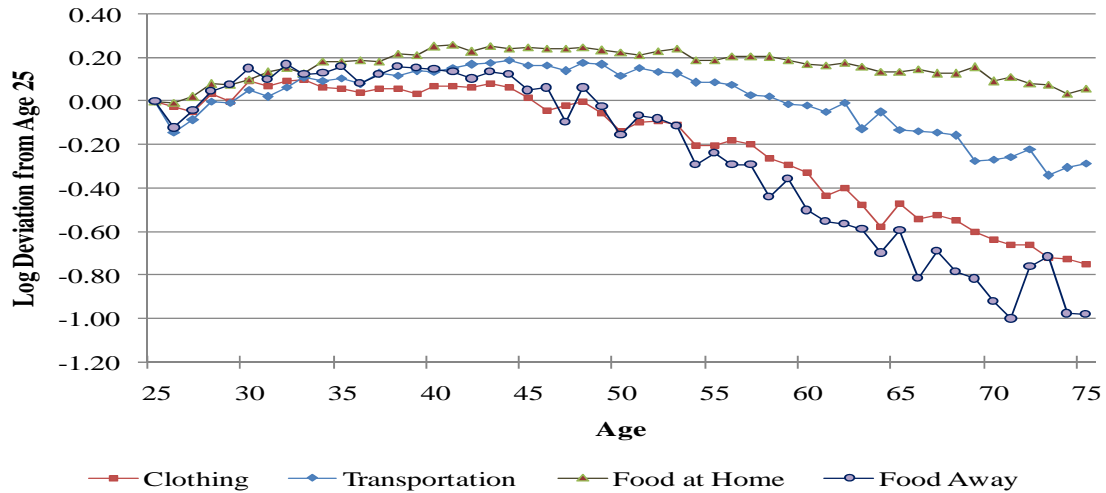
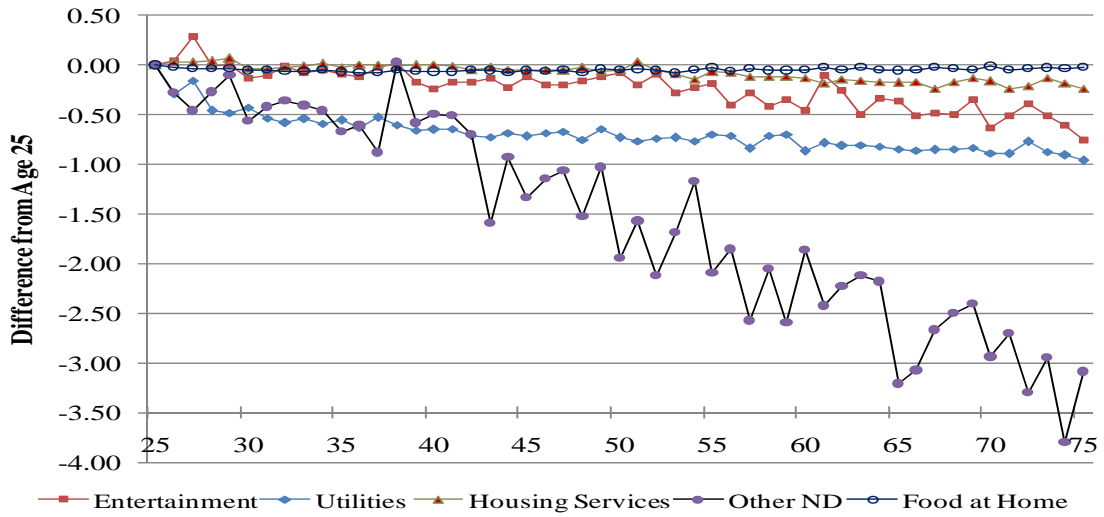


Figure 2b:
Expenditures over the Lifecycle, Categories that Decline After Middle Age

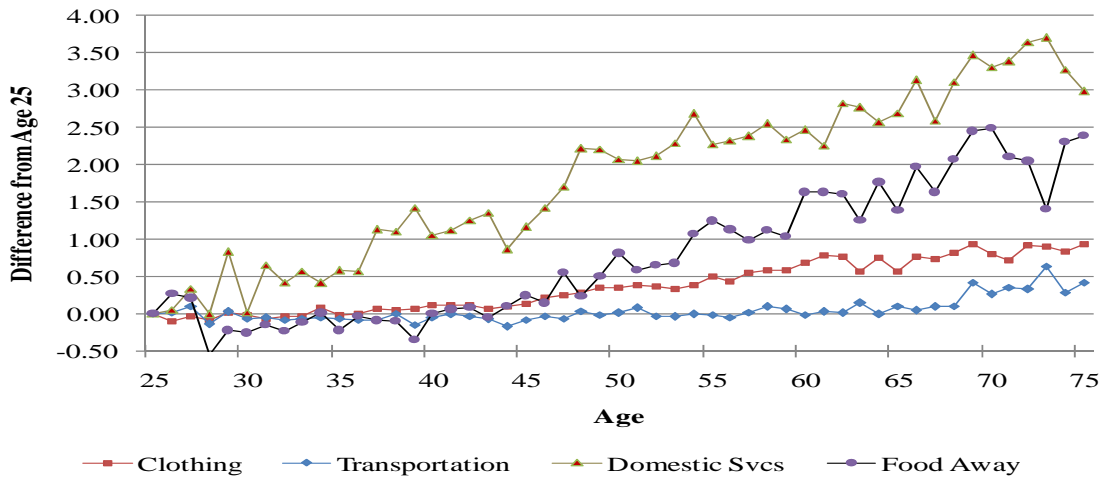


Notes: This figure plots mean expenditure for dis-aggregated consumption categories by age conditional on cohort, normalized year, and family status controls. Each point represents the coefficient on the corresponding age dummy from the estimation of equation 1, with age 25 being the omitted group. The consumption categories depicted in Figure 2a are Entertainment (squares), Utilities (diamonds), Other Nondurables (filled circles), Housing Services (triangle), and Domestic Services (open circles). The consumption categories depicted in Figure 2b are Clothing and Personal Care (squares), Transportation (diamonds), Food at Home (triangle), and Food Away from Home (filled circle). The sample is the same as for Figure 1. See text and data appendix for a discussion of the consumption categories.

**Figure 3a:
Cross Sectional Variance of Expenditure Over the Lifecycle,
Decreasing Variance Categories**

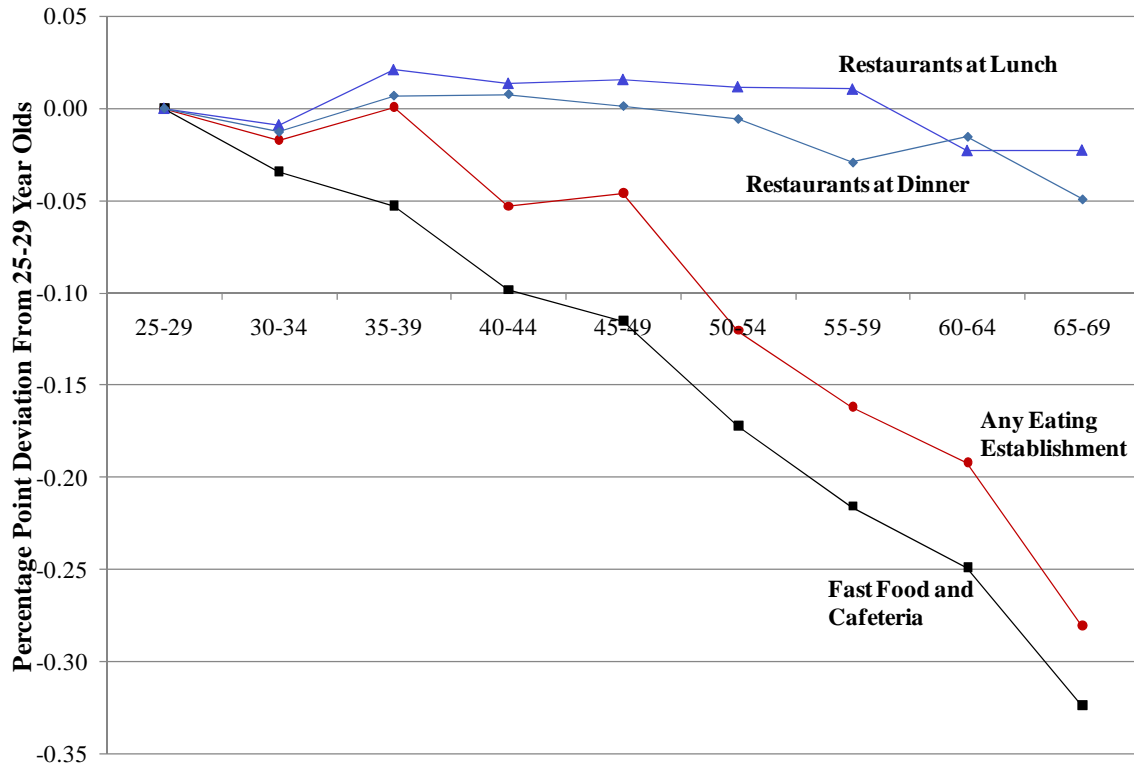


**Figure 3b:
Cross Sectional Variance of Expenditure Over the Lifecycle,
Increasing Variance Categories**



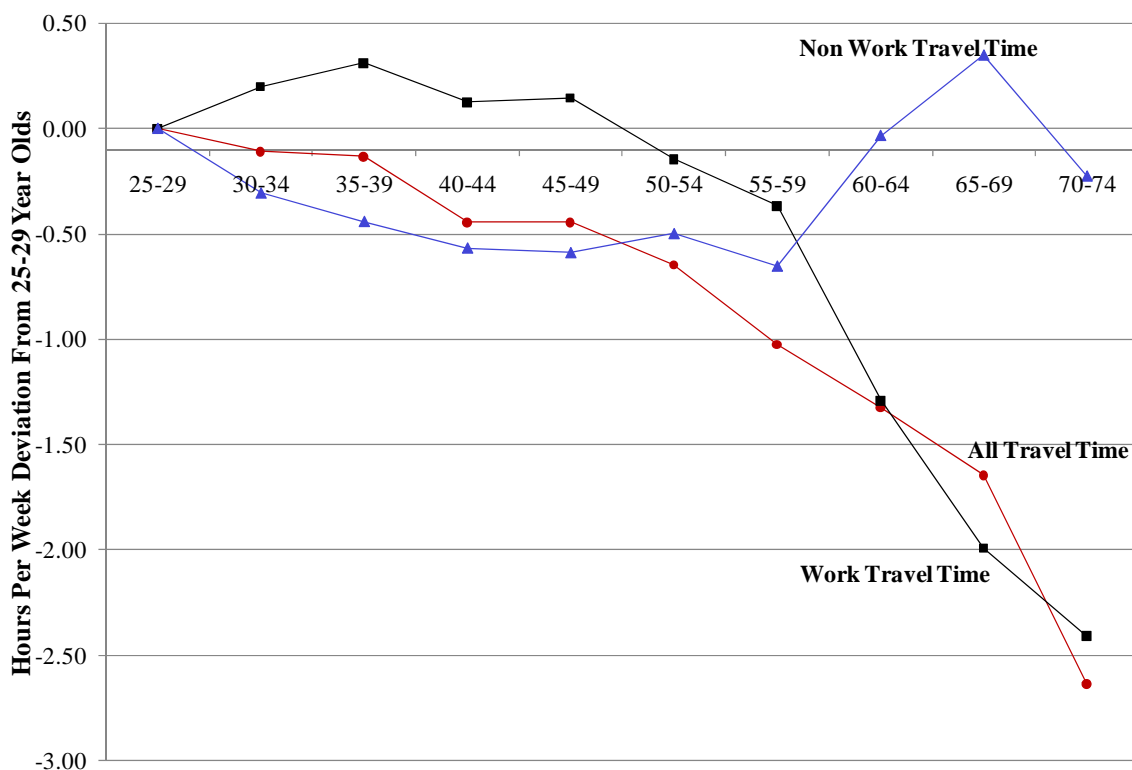
Notes: This figure depicts the life cycle profile of the cross-sectional variance of dis-aggregated log expenditure, conditional on cohort, year, and family composition controls. Specifically, we compute the cross-sectional variance of the residuals from the first stage regression (equation (1)) for each age-cohort pair, and then remove cohort fixed effects to isolate the life cycle profile of cross-sectional variance (equation (2)). Again, all deviations are from age 25. The consumption categories depicted in Figure 3a are Entertainment (squares), Utilities (diamonds), Other Nondurables (filled circles), Housing Services (triangle), and Food at Home (open circles). The consumption categories depicted in Figure 3b are Clothing and Personal Care (squares), Transportation (diamond), Food Away From Home (filled circle), and Domestic Services (triangle). The sample is the same as for Figure 1. See text and data appendix for a discussion of the consumption categories.

Figure 4: Propensity to Eat Away From Home By Establishment Type



Notes: Data comes from the Continuing Survey of Food Intake of Individuals (CSFII) for the years 1989-1991 and 1994-1996. Figure 4 plots the life cycle profile of the propensity to eat at different types of establishments, where propensity is measured by a dummy variable that takes a value of one if the respondent patronized the type of establishment during the course of the food diary and zero otherwise. “Any Eating Establishment” refers to the propensity for individuals to eat at a restaurant, a fast food establishment, a cafeteria, or a bar/tavern during their time in the sample. “Fast Food and Cafeteria” is differentiated from “Restaurants” by whether the establishment has table service. For restaurants “at dinner” and “at lunch” we differentiate whether the establishment was frequented for dinner or lunch, respectively. We regress each dummy variable on five-year age dummies as well as family composition controls, and plot the coefficients on the age dummies. All life cycle coefficients should be interpreted as linear probability deviations from 25-29 year olds. See the text for a discussion of the family size controls. All data are weighted to be nationally representative using the CSFII survey weights. See the text and data appendix for additional details of the CSFII sample.

**Figure 5: Travel Times Over The Life Cycle,
Total Travel Time, Work Travel Time and Non Work Travel Time**



Notes: Data comes from the 2003-2005 American Time Use Sample (ATUS). Figure 5 plots the life cycle profile of the average time spent “traveling” (in hours per week) adjusted for family composition. “All Travel Time” refers to the amount of time individuals spend traveling to/from work (i.e., commuting time) and all other travel time. We regress hours per week on five-year age dummies as well as family composition controls. The figure depicts the coefficients on the age dummies. See the text for a discussion of the family size controls. All age coefficients should be interpreted as hour per week deviations from 25-29 year olds. All data are weighted to be nationally representative using the ATUS survey weights. See the text and data appendix for additional details of the ATUS sample.

**Figure 6: Effect of Work Status on Expenditure Shares:
With (dashed lines) and Without (solid lines) Work Status Controls**

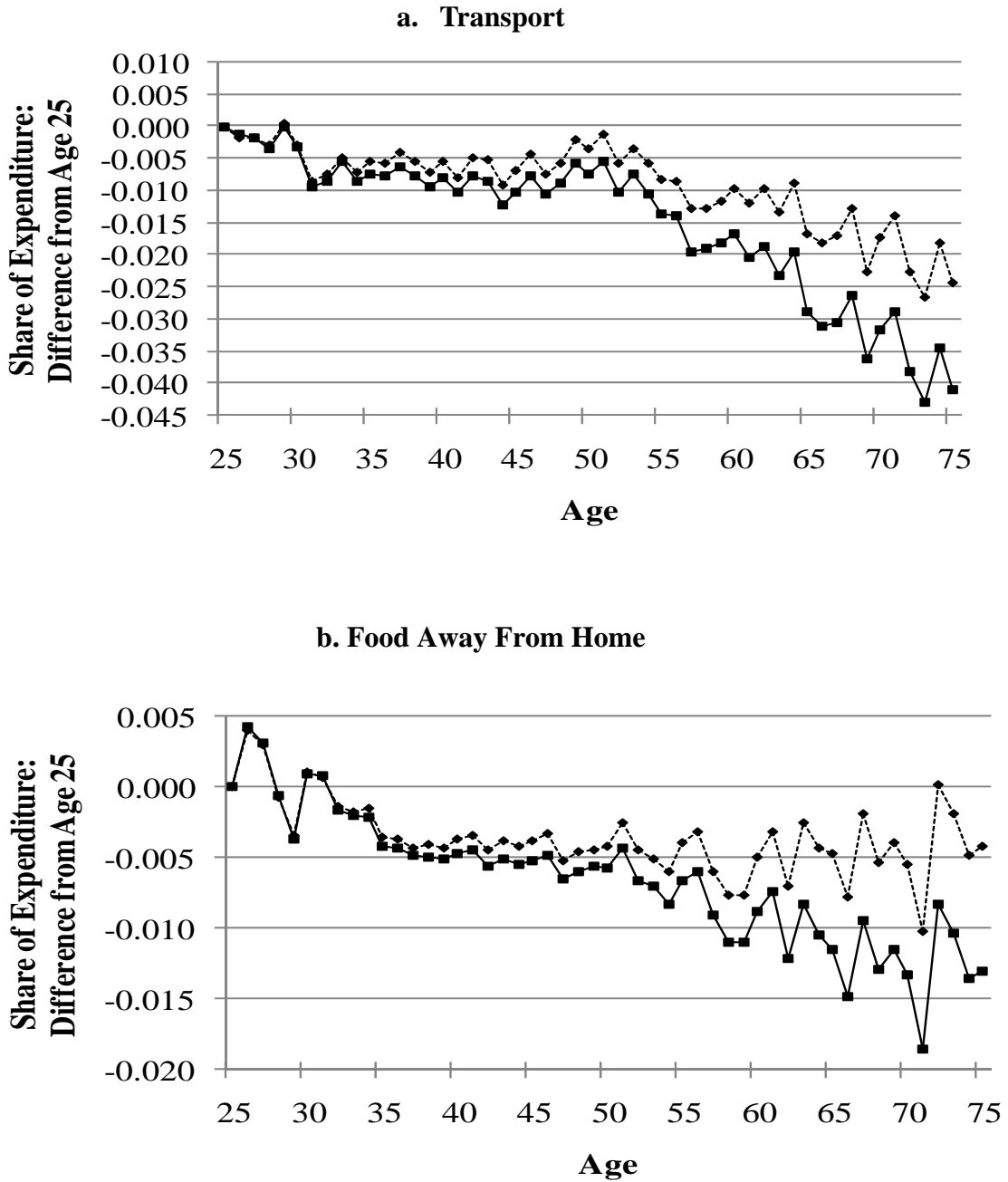
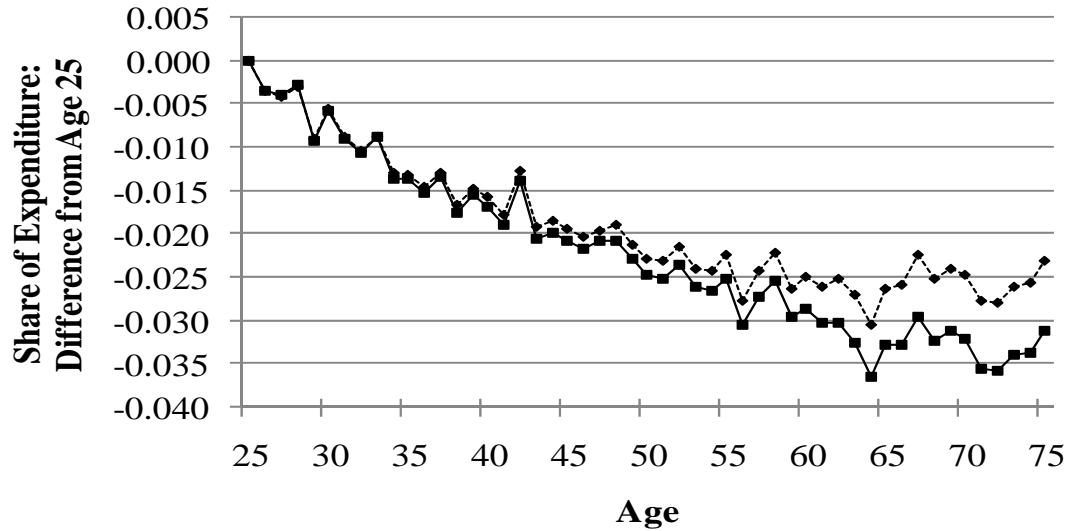


Figure 6 (continued)

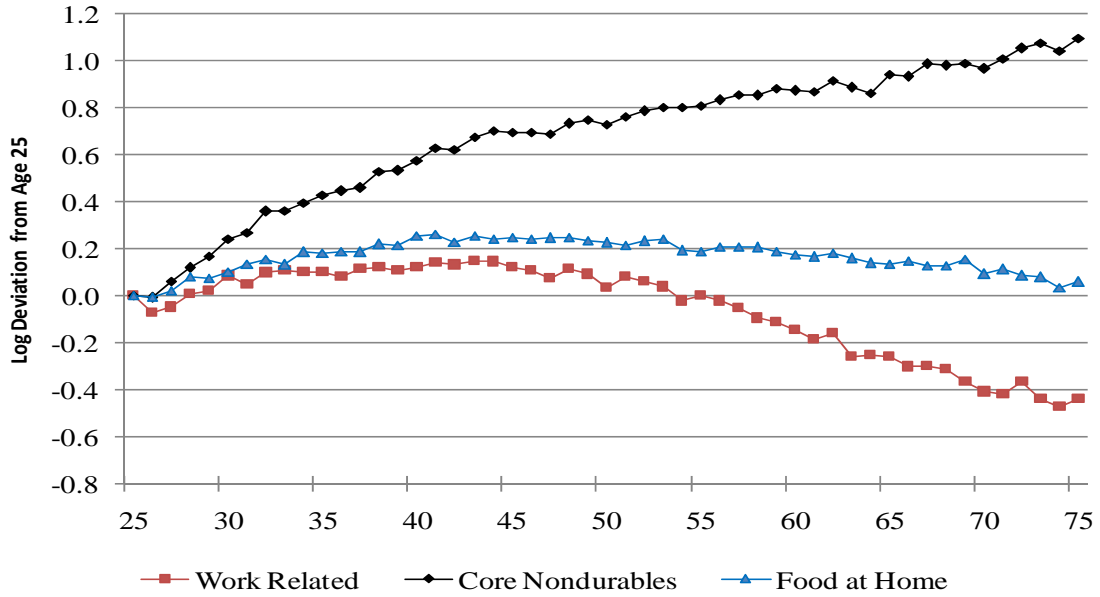
c. Clothing



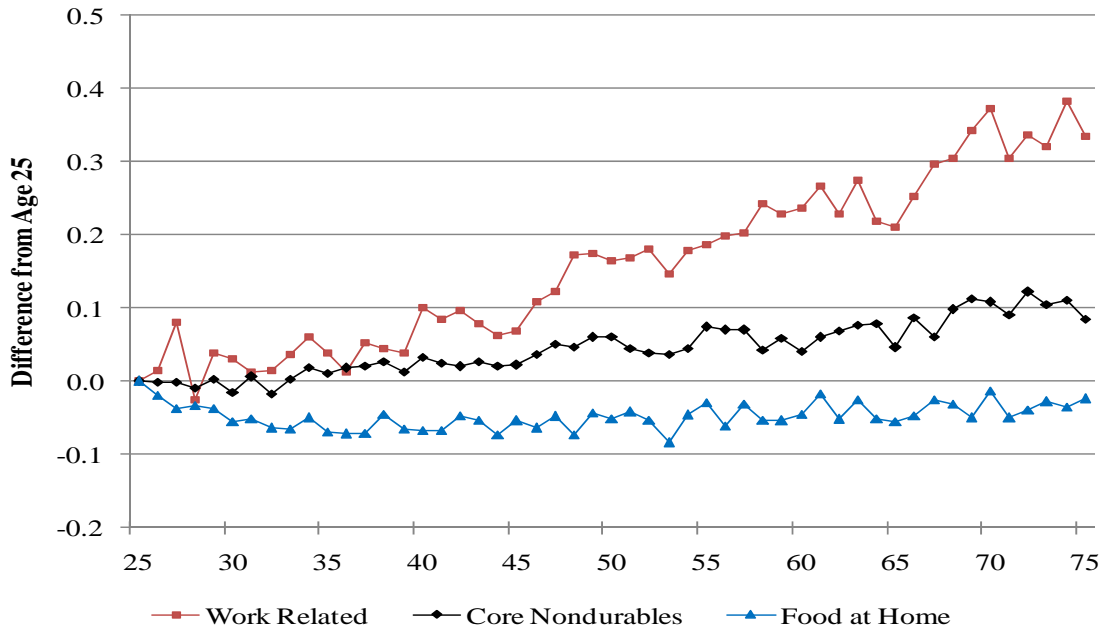
Notes: Figure 6 depicts the age coefficients from regression (3) of expenditure shares on age, cohort, family size, price, and total expenditures, with (dashed) and without (solid) work status controls. Specifically, we regress the indicated category's share of expenditure out of total nondurables (including housing services and excluding alcohol and tobacco) on the standard vector of controls used in Figure 1, plus the full set of (log) price indices for each category indicated in column 1 of Table 3 and the overall CPI deflator, as well as log total nondurable expenditure (see equation 3 in the text). We instrument total nondurable expenditure with a flexible function of total household income and dummies indicating the educational attainment of the head (<12, 12, 13—15, >=16). The figures depict the coefficients on the age dummies. The dashed line differs from the solid line in that the dashed line represents age coefficients in a regression that also includes a vector of work status controls consisting of dummies for the number of hours worked per week and dummies for the number of weeks work during the past year, for both spouses. For the regression analysis, we restrict our sample to include only married households, which is a sample of 34,195 households. Panels A, B and C, depict the share of expenditure spent on nondurable transportation, food away from home, and clothing, respectively.

Figure 7: Summary of Life Cycle Expenditure Patterns

a. Lifecycle Profile of Expenditures: Means



b. Lifecycle Profile of Cross Sectional Variance



Notes: Figures 7a and 7b are identical to Figures 1a and 1b, respectively, except that we disaggregate non-durable consumption into three categories. The categories are food at home (triangles); work related expenses (squares) which include transportation, food away from home, and clothing/personal care; and “core nondurables” (diamonds) which includes all other categories of total nondurable expenditure (including housing services but excluding alcohol and tobacco). See the notes to Figures 1a and 1b for additional sample and estimation descriptions.

Data Appendix

In this appendix we discuss data sets and sample restrictions. All data and programs are posted on our web site (<http://www.markaguiar.com/aguiarhurst/lifecycle/datapage.html>). Some additional robustness exercises can also be found on our website at (http://www.markaguiar.com/aguiarhurst/lifecycle/robustness_appendix.pdf).

A. CEX Data

This paper uses data from the Consumer Expenditure Survey's quarterly interview survey. The survey unit is a household (consumer unit). Each consumer unit is interviewed once per quarter for five consecutive quarters. The first interview collects demographic data and inventories major durables. The subsequent four interviews collect recall data on expenditures over the preceding three months. We collapse the four interviews into a single annual observation per household, summing over the quarterly expenditures. In particular, we do not use the panel dimension of the four quarterly interviews.

While expenditure is reported at the household level, demographics are reported for individuals. We use demographic characteristics reported by the household head. A head is defined as the member who identifies himself or herself as the "head of household" in the survey. If there are multiple heads, we identify the head as the male (if one is present) and resolve any remaining ties by employment (employed over nonemployed), age (eldest), and marital status (married over non-married).²⁹

We use the extracts compiled by Ed Harris and John Sabelhaus and provided by the NBER (http://www.nber.org/data/ces_cbo.html). All data, programs, and documentation for this paper can be found on the authors' website (www.markaguiar.com/aguiarhurst/lifecycle/datapage.html). Harris and Sabelhaus

²⁹ There are a handful of households with multiple heads who share the same sex, age, employment status, and marital status (as well as household size). However, as these are the only demographic variables used in this paper, this duplication is immaterial to identifying the demographic characteristics of the household.

aggregate expenditures into 47 categories, which are listed in the documentation posted on the authors' website. The mapping from our consumption categories to their 47 categories can be found in Appendix Table A1. The Harris and Sabelhaus dataset includes households whose first interview was conducted between the first quarter of 1980 and the second quarter of 2003. Due to changes in the survey methodology, data from the last two quarters of 1985 and 1995 are omitted.³⁰ The data set contains a total of 167,133 households.

We restrict the Harris and Sabelhaus sample in the following ways. First, we keep households whose heads are between age 25 and 75. To obtain reliable estimates of cohort effects, we also restrict attention to cohorts with at least 10 years of data. In particular, we restrict the sample to households born between 1915 and 1968. That is, to households whose head is at most 65 in 1980 and at least 35 in 2003. This leaves 122,962 households. Second, the household must have completed all four expenditure surveys, providing a complete picture of *annual* expenditures. There are 75,883 such households in the sample, or roughly 62 percent. Harris and Sabelhaus provide adjusted weights to use with the restricted sample. However, the restricted sample of Harris and Sabelhaus also excludes households with incomplete income reports and students. Usage of their adjusted weights necessitates excluding these households as well, leaving 58,305 households.

Our final sample restriction is that households must have strictly positive expenditure on six major expenditure categories: food, housing services, utilities, clothing and personal care, nondurable transportation, and nondurable entertainment. Roughly 92 percent of the sample satisfied this last criterion, resulting in a sample of 53,412 households. This is our main sample for analysis.

B. Data From American Time Use Survey (ATUS)

We use the 2003, 2004, and 2005 waves of the American Time Use Survey (ATUS) conducted by the U.S. Bureau of Labor Statistics (BLS). Participants in ATUS,

³⁰ Prior to 1984, only urban consumers were surveyed. Exclusion of these years does not significantly alter the results reported in the paper.

which includes children over the age of 15, are drawn from the existing sample of the Current Population Survey (CPS). The individual is sampled approximately 3 months after completion of the final CPS survey. At the time of the ATUS survey, the BLS updated the respondent's employment and demographic information. The ATUS waves totaled 20,720, 13,973, and 13,038 respondents in 2003, 2004, and 2005, respectively. We restrict our sample to respondents aged 25 through 75, resulting in sample sizes of 16,860, 11,436, and 10,580, respectively. We pool these 38,876 respondents into a single cross section.

The survey uses a 24-hour recall of the previous day's activities to record time diary information. The unit of analysis is an individual, and only one individual per household is surveyed. We control for effects of marriage and family size by regressing the amount of time (in levels) for a specific activity on age controls, a dummy for marital status, and ten family size dummy variables, and report the coefficients on the age controls.

The ATUS reports time allocation using over 400 detailed activity codes. For our analysis we focus on three aggregates: total travel time (classification category 17 in 2003 and 2004 classification category 18 in 2005), travel associated with work (sub category 4 out of total travel time), and all other travel time.

C. Data from Continuing Survey of Food Intake of Individuals (CSFII)

For the analysis in Table 4, we use data from the *Continuing Survey of Food Intakes by Individuals* (CSFII) collected by the U.S. Department of Agriculture. The survey is cross sectional in design and is administered at the household level. We pool the two most recent cross sectional surveys; the first interviewed households between 1989 and 1991 (CSFII_89) and the second interviewed households between 1994 and 1996 (CSFII_94).

The CSFII_89 and CSFII_94 were designed to be nationally representative. Based on sample averages, the demographic coverage of the CSFII closely tracks that of the PSID. The 1989 data also includes an additional data set that oversamples low income households. We exclude the oversample from our analysis. When analyzing individual-level data, we restrict our analysis to household heads.

Each household member in the CSFII data also filled out detailed food diaries, recording their total food intake during a particular 24-hour period, with the CSFII_89 collecting three days and CSFII_94 two days of diaries, respectively. As part of their entries, they had to record where their food was purchased. We focus on the food purchased at non-grocery establishments. In particular, we only examine food purchased at restaurants with table service (restaurants), restaurants with counter service (fast food establishments), cafeterias, and bars. Collectively, we refer to these categories as food purchased away from home.

The data sets track standard economic and demographic characteristics of its survey respondents including age, educational attainment, race, gender, occupation, employment status, hours worked, retirement status, family composition, geographic census region, whether the household lives in an urban area, home owner status, and household income. The survey also asks respondents detailed questions regarding health status, health knowledge, and preference for nutrition.³¹

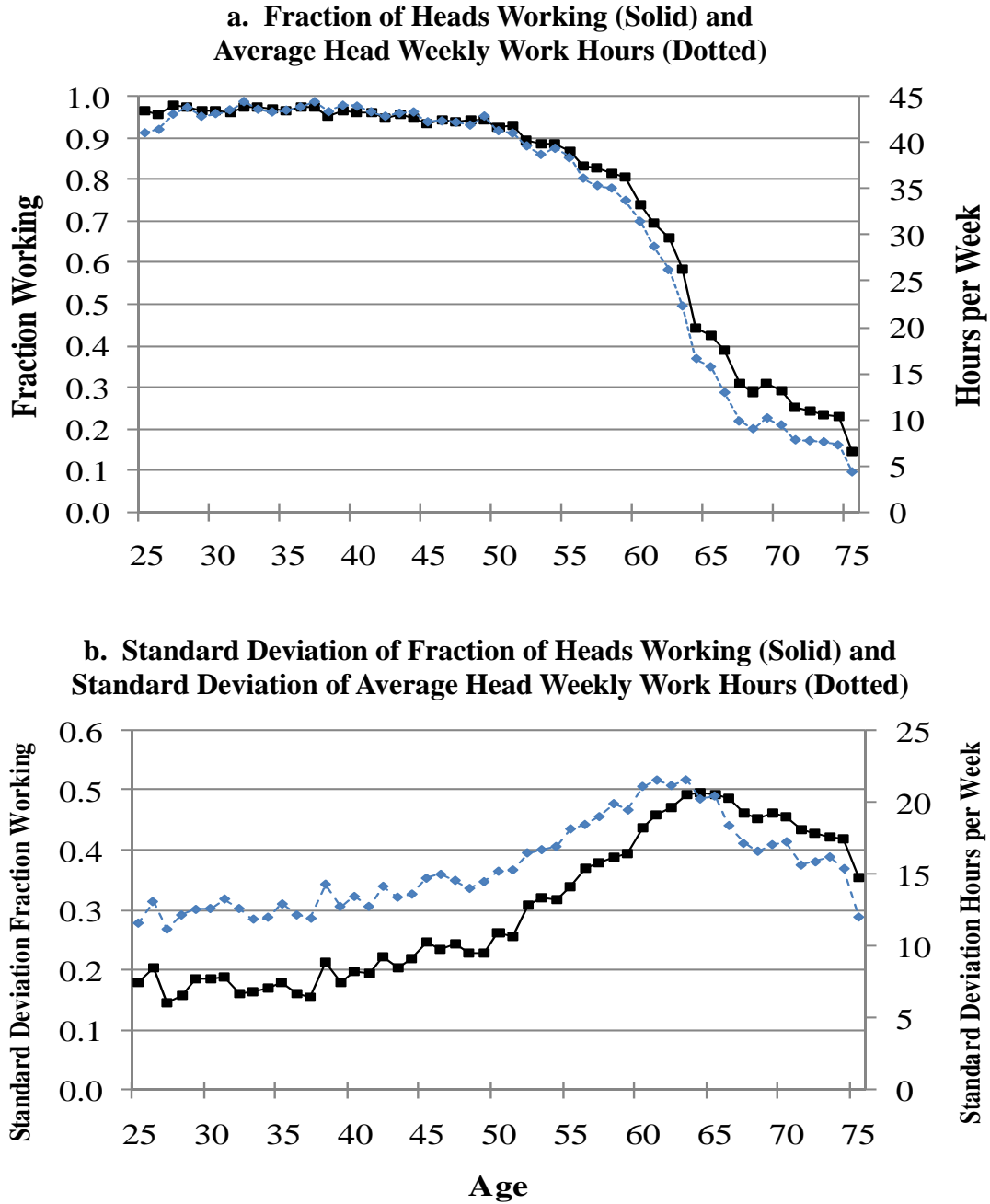
³¹ See the Data Appendix of Aguiar and Hurst (2004) for a detailed discussion of the CSFII survey methodology and a comparison of the sample demographics in the CSFII to the sample demographics from other large household based surveys.

**Appendix Table A1: Mapping Consumption Categories
into the Harris and Sabelhaus Classification**

Our Category	Harris and Sabelhaus Category
Food At Home	Food Off Premise (23)
Food Away From Home	Food on Premise (24), Food Furnished Employees (25)
Alcohol and Tobacco	Tobacco Products (26), Alcohol Off Premise (27), Alcohol on Premise (28)
Clothing and Personal Care	Clothing and Shoes (29), Clothing Services (30), Jewelry and Watches (31), Toilet Articles and Preparation (32), and Barbershops, Beauty Parlors, and Health Clubs (33)
Utilities	Electricity (38), Gas (39), Water and Other Sanitary Services (40), Fuel Oil and Coal (41), Telephone and Telegraph (42)
Domestic Services	Domestic Services, Other Household Operations (43)
Transportation	Tires, Tubes, Accessories, and Other Parts (53), Repair, Greasing, Washing, Parking, Storage, and Rental (54), Gasoline and Oil (55), Bridge, Tunnel, Ferry, and Road Tolls (56), Auto Insurance (57), Mass Transit Systems (58), Taxicab, Railway, Bus, and Other Travel Expenses (59)
Entertainment	Recreation Services (64)
Other Non Durables	Airline Fares for Out of Town Trips (60), Pari-Mutuel Net Receipts (65), Charitable and Political Giving (69)
Housing Services	See Text For Details

Notes: See online documentation to the NBER CEX files for examples of specific expenditures included in the Harris and Sabelhaus classification at http://www.nber.org/data/ces_cbo.html.

Appendix Figure A-1: Mean and Variance of Work Over the Life Cycle



Notes: Figures A-1a shows the life cycle profile of the propensity to work (solid line, left axis) and average hours per week worked (dotted line, right axis) for household heads. The average hours per week series is not conditional on working. No other controls are used to adjust these series. The sample is identical to the sample described in the Note to Figure 1a. Figure A-2b shows the corresponding life cycle profile of the standard deviation of the propensity to work (solid line, left axis) and average weekly work hours (dotted line, right axis) for household heads.