Consumer Time Budgets and Grocery Shopping Behavior*

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Abstract

Home production not only requires money to buy market goods but also varying degrees of time to shop and to prepare consumption goods. Households' time budgets therefore affect their use of the market and the bundle of market goods chosen. Using a novel household panel data set that combines purchase records with time-budget shifting labor-events, and controlling for demographics, this paper shows how the availability of time affects purchasing behavior. We first find that more discretionary time, due to, e.g., retirement, leads to additional shopping trips across a more diverse set of stores, increased spending on groceries, and more diversity in products chosen. In addition, when time is less scarce, restaurant expenditures go down and grocery expenditures go up. We next classify products according to the time it takes to turn them into consumption experiences. Availability of additional time shifts a household's shopping bundle towards more time-intensive market goods. Our results suggest that product- and retail innovations aimed at forward-integrating into household production are important drivers of demand in CPG industries.

Keywords: consumer purchase behavior, household production, time use, retirement.

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1 Introduction

A substantial part of modern marketing practice provides value to consumers by lowering their time cost of purchasing, home production, and consumption.[1] Popular media claim that demands on the consumer's time are higher than ever before and that consumers experience difficulty coping with time scarcity (The Economist, 2014; Robinson and Godbey, 2005). Yet, despite this practical and societal relevance, the role of time budgets in formalizing and explaining consumer choices has received relatively little attention in quantitative marketing and economics, especially compared to the role of income and money budgets. Indeed, there is a general lack of empirical work on how the availability of time affects a household's choices among market goods and its use of the market. This paper contributes to our understanding of this important relationship by using detailed household level data to study how shifts in the availability of discretionary time affect grocery purchasing and consumption behavior.

Our point of departure is to think of household purchasing through the lens of the consumption theory proposed by Becker (1965) and Muth (1966). In this theory, consumers maximize utility from consumption, subject to a time constraint. The portion of time allocated to the labor market earns income, which is used to buy *market* goods. *Consumption* goods are made by households from quantities of market goods and quantities of time, in a way that is formalized by a household production function. This household production function acknowledges various uses of time that include cooking but also a household's use of the market, i.e., shopping, queuing, travel, etc. Thus, in this consumption theory, products and services come at two costs to a household: the price paid at check out and the time required to convert market goods into consumption. One common thread

[1]This includes large parts of retail distribution, assortment management, informative advertising, manufacturer product design, and almost all of service marketing.

in this literature is that households trade time for a lower price (e.g., Nevo and Wong, 2015).

A particular consumption good can often be home-produced in more than one way, each involving different bundles of market goods and time inputs. This raises the question how the choice among bundles of market goods depends on the household's shadow price of time. Do households increase the usage of the market as a distribution system and invest more time in shopping when the shadow price of time decreases? Do they demand more market goods and prefer a higher degree of varieties at the time cost of extra evaluation? Conversely, to what extent will households outsource their home production tasks to the market by choosing restaurants over grocery stores or ready-to-eat market goods over time-intensive ones, when time becomes more scarce? This paper seeks to answer these questions.

Despite the importance of answering these questions to understand household purchase behavior and market equilibrium, data limitations have prevented a systematic analysis of how households' purchase behaviors are moderated by different levels of discretionary time, i.e., different time budgets.[2] Our data come from GfK's ConsumerScan Panel, tracking the Dutch grocery market. It is particularly suitable for the purpose of our analysis, as it combines detailed purchase records with annual surveys on household characteristics and self-stated preferences for home production. From this data, we extract all food-related purchase records from the 6,814 households who record their purchases between 2009 and 2013. The survey data include yearly retirement and unemployment status. We use changes in these variables as plausibly exogenous shifters of the time that is available for food-related shopping and home production activities. Our panel data enable us to control for household fixed effects, covering all permanent drivers of demand. Our

[2]In the past, studies often lacked a panel data structure and good controls to isolate the role of time budgets in affecting behavior. For example, purchase behaviors can alternatively change from changes in income or household-specific tastes for home production (e.g., households' utility from cooking or shopping may change). Therefore it is essential to account for household demographics and home production preference (Stratton, 2012).

data also allow us to account for observed changes in home production preferences and in demographics (including income, age, and household size). These rich controls allow us to give a causal interpretation to our estimates of the time effect on grocery purchasing. We regard retirement as being accompanied by a permanent positive shift of time availability. In contrast, we regard unemployment as leading to a temporary shift in time availability in the eyes of most consumers.

Our analysis is organized along three related dimensions of purchasing behavior. First, the market serves as a distribution system that makes market goods available. A household incurs time costs accessing this distribution system, e.g., transportation time to visit grocery stores (Hotelling, 1929; Salop, 1979), or waiting time at check outs. Therefore, a time constrained household may take fewer trips and visit fewer stores. Second, the market offers a large variety of goods. Evaluation costs and lack of experience make time inputs for home production rise in variety (Bronnenberg, 2015; Huang and Bronnenberg, 2018). Therefore, a time-constrained household, i.e., one with a high shadow price of time, may choose to buy a smaller subset of desired varieties. Third, the market offers food options, product categories, and varieties with diverse time costs. A time-constrained household may selectively avoid time intensive home-production and choose food options accordingly. Alternatively, the household may outsource part of the home production tasks to the market—e.g., purchase ready-to-consume products rather than their relatively more time-consuming substitutes (Becker, 1965; Gronau, 1977). We develop measures for all three purchase dimensions (shopping activity, basket variety, and substitution into time intensive market goods) in Section 3.3. Then, we document how household purchase behaviors along these three dimensions depend on labor market status.

Controlling for demographics, household composition and time invariant heterogeneity, we find a strong relationship between a household's available time for home production and its shop-

ping behavior. Households make more use of the market as a distribution system –undertake more shopping trips and visit more stores per shopping trip– after experiencing a positive shock on available time. Households also increase variety in their purchases. Moreover, larger time-budgets lead to more spending on grocery goods and less spending on eating out. Finally, households with larger time-budgets substitute within a given category into products that are more time intensive. These effects are stronger for retirement than for unemployment, in line with the view that the former is permanent while the latter is temporary.

This paper proceeds as follows. Section 2 contains an overview of how we contribute to the literature. In Section 3, we describe our data. Section 4 presents the empirical approach and the results along with some robustness checks. Section 5 concludes.

2 Literature

Our work contributes to various strands of the literature. An early literature in marketing studied home production and consumer strategies to reduce time inputs (see, e.g., Nickols and Fox, 1983). Nickols and Fox (1983) found that dual labor households employ both time-buying strategies (e.g., child-care) and time-saving strategies (e.g., reducing time in home production or leisure) to deal with the time pressures originating from dual participation in the labor force. We contribute to this literature by showing detailed accounts of how availability of time affects purchasing behavior and home production. For instance, we document that as consumers get more time, they spend less on restaurants and more on groceries holding, e.g., income constant.

Next, there is a literature that views one function of retailing as shifting the purchasing costs from consumers to the market, e.g., via provision of distribution services (Betancourt, 2004).

Among other things, this literature investigates the relationship between one-stop shopping, retailer competition, and pricing (e.g., Bhatnagar and Ratchford, 2004; Baye et al., 2017; Caprice and Schlippenbach, 2013; Messinger and Narasimhan, 1997; Thomassen et al., 2017). Our results support the view that an important driver of the costs incurred by the household is the time spent on undertaking shopping trips, including the time it takes to search and examine the products. We find that households undertake more shopping trips and are more likely to visit multiple store when they have more time.

Another stream of the literature investigates the costs and benefits of purchasing variety (e.g., Berger et al., 2007; Bronnenberg, 2015; Hamermesh, 2005). We contribute to this literature by finding a positive effect of a household's time budget on its demand for variety. Our findings support the idea that households face fixed (to quantity) purchasing and evaluation costs that limit their demand to a subset of varieties (see also Huang and Bronnenberg, 2018). More generally, our findings link existing trends in household time allocation (e.g., a higher ratio of female labor force participation and higher demand for leisure) with the direction of recent retail innovation. We document a strong relationship between a household's available time and its shopping trip choices, overall expenditure on grocery goods, desired amount of variety, and its preference for time-intensive versus convenient goods. Hailing back to an earlier literature in marketing, our results suggest that changes in modern households' lifestyle as well as labor participation may have a non-negligible influence on a retailer's shelf-allocations and investments in providing convenience, and on a manufacturer's direction of product innovation into market goods that require less time to convert to consumption items.

Finally, there exists a large literature that documents the trends in household time use over long periods of time and/or documents stylized patterns in multi-nation time use data (Aguiar and

Hurst, 2007b; Kimmel, 2008; Ramey, 2009; Ramey and Francis, 2009; Aguiar et al., 2012; Lee et al., 2012; Aguiar et al., 2013; Kawaguchi et al., 2013; Duernecker and Herrendorf, 2015). The recent interest in macroeconomic- and growth-models that incorporate home production (see for example Benhabib et al., 1991; Greenwood et al., 2005; Francis and Ramey, 2009) require reliable estimates of long-run trends in time use. Another set of contributions (including Biddle and Hamermesh, 1990; Solberg and Wong, 1992; Cutler et al., 2003; Aguiar and Hurst, 2005, 2007a; Bertrand and Schanzenbach, 2009; Meyer and Sullivan, 2008; Stratton, 2012; Stancanelli and van Soest, 2012; Nevo and Wong, 2015) uses information on consumption and time use (sometimes as macro-level shocks to households' time and money budgets) to answer questions related to household well-being, i.e., consumption, sleep, leisure, and gender differences in time use. Most of these papers use survey data on household consumption expenditure. The only exception is Nevo and Wong (2015), who exploit scanner data on detailed household shopping budget choices and shopping trip decisions. Our contribution to this time use and consumption literature is threefold. First, we provide direct household-level evidence on how much changes in time budget influence a household's purchase behaviors. With our rich survey panel data and scanner panel data, we are able to control for income, and time-invariant unobserved household heterogeneity. Second, we systematically document household purchase behaviors based on how they make use of the market. We find that time-scarce households tend to "outsource" home production—buy convenient goods rather time-intensive goods. Third, our paper relates to the literature on the "retirement consumption puzzle" summarized in Hurst (2008). The general finding in the U.S. context is that food expenditures fall, because individuals dramatically increase the amount of time they spend on home production, substituting expensive products by cheaper and often time-intensive ones, and because they buy the same products at lower prices (Aguiar and Hurst, 2007a). We find signifi-

cant increases in grocery expenditure, desired variety in food purchases, the number of shopping trips and multi-stop shopping trips, and time-intensity level of the household's shopping basket. Our findings are consistent with home production theory and provide a micro explanation for the "seemingly" different post-retirement preferences for grocery goods.

3 Data

3.1 Households

Our data are drawn from GfK's ConsumerScan panel and cover five years of grocery purchases for a national sample of Dutch households, starting at the beginning of 2009 and continuing until the end of 2013. GfK provides weekly monetary incentives to panel members to report their purchases. Each household is given a handheld device to scan the barcodes of products that were purchased across a near-exhaustive set of retailers. Households record the barcode, the retailer from which the product is purchased, and during which part of the day of a specific date the transaction takes place.[3] In addition to collecting scanner data at the household level, GfK also conducts a demographic survey of the Dutch panelists each year. From these data, we construct a purchase panel of 6,814 households who actively scan purchases and for whom basic demographics –age of the household head, household composition, income, and labor market status as defined below– are not missing.

Table 1 shows descriptive statistics for age and household composition. We first average demographics over all available years and then provide statistics of these household averages for the full

[3]Each day contains three day parts in GfK's definition: (1) before noon, (2) between noon and 6PM, and (3) after 6PM.

unbalanced panel (in which purchase data or basic demographics are missing for some years) and a balanced panel (where we have purchase data and basic demographics for all years). The average age of the household head in the unbalanced panel is 52.51 years, and a typical household in our data has 2.5 members. Aside from demographic variables, the survey elicits preferences regarding shopping and cooking. Dutch households self-report to be neutral with respect to being guided by prices in their grocery purchases, and they state positive preferences for cooking at home.

–insert Table 1 here–

The table also shows that households in the balanced panel are similar to households in the unbalanced panel in terms of demographics. This suggests that selective attrition is not a concern for our analysis. In the following, unless mentioned otherwise, we report results for the unbalanced panel.[4]

3.2 Labor market status and time use

The survey elicits retirement and unemployment status, and time spent on domestic versus market work for each household member. In addition, it asks about net monthly household income. Domestic work includes cooking, cleaning, and shopping. Our aim is to characterize the effects of labor market events that shift the availability of time for housework and potentially affect the household's grocery purchase behavior. For this, we define indicators that take on the value one when either the household head or the partner or both are retired or unemployed. The underlying hypothesis is that household behavior will change as soon as one person has more available time

[4]The table shows that households in the full sample are observed 3.5 years on average, while they are observed 5 years in the balanced sample. This means that that by focusing on the balanced panel we would lose about 45% of the observations ($(2602 \cdot 5)/(6814 \cdot 3.46) \approx 0.55$). We have re-run all analyses for the balanced sample and found highly similar results.

due to retirement or unemployment.[5] From now on, we call these households retired or unemployed.

Table 2 shows that in 29% of household-years there is at least one retiree and in 4% of household-years there is at least one unemployed household member. Further, Table 2 shows that in a typical week, households report to spend 51.27 hours in the labor market, and 21.50 hours on domestic work. Total net monthly family income from market work is €2177. Looking at the last column, note that information on time use is missing for some years for some of our households. We have not dropped these observations because these variables will not be used in our main analysis in Section 4.

–insert Table 2 here–

Although we have direct measures of self reported time use, we don't believe that the variation in time use is a good proxy for time availability because it is chosen by the household in a way that may be related to unobserved preferences for foods or constraints. Therefore, our approach is to relate grocery purchases to within-household variation in shifters of time availability like the presence or absence of the first retired or unemployed household member. The second-to-last column in the table shows there is ample variation within households of both the retirement and unemployment indicators.

Next, Table 3 shows the results from regressions that substantiate that our measures of retirement and unemployment shift time budgets at the household level. The specification is the same as in our main analysis and is described in more detail in Section 4 below. In brief, our main

[5] We also experimented with other measures. For instance, we have also used the number of retired or unemployed individuals or separate indicators for the household head and the partner. Results with these alternative measures were remarkably similar. For instance, compare Appendix Table A.3 in which we use the number of retired and unemployed household members to Table 6 (discussed below) in which we use the indicators.

regressors are the retirement and unemployment indicator, respectively, and we control for household and time fixed effects, as well as age of the household head and household composition. We first regress the number of hours the household members spend together on domestic work and on market work, respectively, on whether at least one household member is retired or unemployed. We expect retirement and unemployment to be associated with more time spent working at home and less time working in the market. From the first row in Table 3, we see that the first retired household member is associated with 20.9 hours less work in the market and 0.4 hours more in domestic work. Furthermore, the first unemployed individual in the household is associated with 26.3 hours less work in the market and 0.8 hours more in home production per week. This shows that retirement and unemployment have sizable effects on the availability of time, while our measure of time spent working at home is affected much less. This could either be because retirement and unemployment have no sizable effects on the amount of time that is spent purchasing, preparing and consuming goods, or because the measure of time spent on home production in our survey is too narrow. In light of the stark effects we find in our main analysis the latter seems more likely.[6]

–insert Table 3 here–

Results presented in the third column show that reported household income is not affected significantly by retirement and unemployment. This is likely caused by the Dutch social security system whose aim it is to offset a drop in income at retirement as much as possible (see for instance Bovenberg and Meijdam, 2001). In the same vein, unemployment benefits are meant to compensate for income losses that are due to unemployment. As information on income is missing about 14% of the time when the other variables are non-missing, there is a trade off about controlling for it in

[6]This is the effect of at least one household member being retired on the total amount of time spent on housework. We also looked into composition effects and find that the effect on the time spent working at home by the person retiring is generally larger than the overall effect, meaning that the partner spends less.

our analysis below. However, income may shift for other reasons, and we therefore present results with income controls.[7] This also makes our analysis more comparable to settings like the U.S., and it helps interpretation of our results as stemming from shifts in the time budget and not shifts in income that are associated with it. We think of this as an advantage of our empirical setup, as we are not interested in the effects of retirement and unemployment *per se*, but in characterizing how a change in the available time affects grocery shopping behavior. Recall that the second column shows that the additional amount of time that becomes available to the household is 21 and 26 hours per week, respectively.

The second to last column shows that retirement and unemployment are associated with a higher stated preference for price shopping. In our analysis below we however find no evidence of households actually engaging in more price shopping.

Finally, the last column of the table shows that, interestingly, preferences to cook at home are not associated with retirement and unemployment. This is in line with the view that we can meaningfully distinguish between preferences and constraints when studying economic activity and that the effects on home production measured in this study (reported and discussed in Section 4) are more likely to come from shifts in the time budget than from shifts in preference for home production.

[7] We note that our results replicate in the larger sample that includes all households. To assess this, we have re-run the regressions in Table 6 while including the 14% households with missing income data. Excluding income as a control, Table A.4 shows that the results are very similar. The same is true for the other results in the paper, presented below.

3.3 Purchase behaviors

Our empirical goal is to investigate to what extent a household's available time affects (1) its use of the market in terms of shopping frequency and scope, (2) its use of grocery shopping and home production for food consumption (as opposed to, e.g., visiting a restaurant), and (3) the extent to which it buys more or less time-intensive products to be turned into consumption experiences. With this in mind, we construct three groups of measures to capture household behaviors.

First, we measure household decisions about the amount of travel and shopping time with three constructs tracking annual shopping behavior—the number of shopping trips (which may combine multiple retailers), the number of retailer visits, and the number of unique retailers visited. We expect that more available time, due to retirement or unemployment, is associated with a greater willingness to incur travel costs and spend time on shopping. Therefore we expect the availability of time to be associated with more shopping trips, more retailer visits in a year, and a greater diversity of retailers visited. One motive that households may be motivated by is the opportunity to benefit from temporal variation in prices (see also, e.g., Aguiar and Hurst, 2005), as investing time will allow them to buy the same products at lower prices. Similarly, the consumer may like more variety. Some of this variety will be exclusively available from a single retailer. Given more time to shop or cook, the consumer can convert windfalls in the time budget into visiting more retailers to find lower prices and more variety in home production. Table 4 provides sample statistics for these measures. The average household in our data is observed to make 131 shopping-trips per year, covering a total of 187 retailer visits across 15 unique retailers.

–insert Table 4 here–

Second, we measure households' total grocery demand by their grocery expenditure, volume,

and the number of purchased varieties. Households make choices between different food options, which include meals produced at home and meals bought in the market (e.g., restaurants, or home delivery). Compared to eating out, buying groceries and undertaking home production are more time intensive. For this reason, we expect that a shift in time availability makes households substitute out of buying read-made meals in restaurants and into buying more grocery goods as ingredients for home producing food. We expect that households also buy more varieties when given more time to examine, search and buy different products. Table 4 shows that the average household in our data scans €2791 worth of food items a year and buys about 627 unique different Universal Product Codes (UPCs) in food.

Third, we measure the time intensity of the bundle of products purchased by the consumer, i.e., how time-consuming it is for the consumer to convert the varieties purchased in the store into meals at home by means of home production. For each UPC, GfK's product directory provides a detailed description and membership of subcategories and categories. We look for categories that contain time-intensive and goods-intensive products and next test for within-category shifts associated with a time-budget shock. We start by selecting 5 categories, Meat, Vegetable, Fruit, Seafood & Shellfish, and Potatoes, for (1) being the largest primary inputs in the home production of meals, (2) belonging to the 20 largest food categories (see Appendix Table A.1), and (3) containing ample time-intensive and goods-intensive subcategories that are close substitutes (e.g., unprocessed raw potatoes and peeled pre-washed potatoes). We choose not simply the largest categories outright, several of them containing only goods-intensive subcategories (e.g., beverages). Using a dichotomous classification, the three authors assessed individually whether each of the subcategories is time- or goods-intensive (within category). Next, these three separate assessments were aggregated and each subcategory was assigned its majority classification. Appendix Table

A.1 gives details about our classification, including examples of subcategories. For instance, in the category meat, we classify the subcategory "meat, beef fresh" as a time intensive alternative and "frozen meat snacks" as a goods intensive alternative. Table 4 shows that the average household in our data scans about €778 a year in the 5 categories used to measure time intensity. Of this expenditure, €510 (66%) is spent on goods we classify as time-intensive and the remainder is spend on goods-intensive products.

As an alternative to this classification –and as a robustness check– we also classify categories as either goods- or time-intensive using panelists' self-reported preferences for cooking at home. Specifically, we relate the cross-sectional variation in households' self-reported willingness to spend time on cooking to expenditures in different sub-categories. The underlying idea is that our measure of the willingness to spend time on cooking reveals which sub-categories are time intensive because those households with a higher willingness to spend time on cooking allocate a larger share of their budget to these subcategories. Thus, in addition to classifying subcategories as goods- or time-intensive directly, we alternatively classify them based on their purchase shares among the households with the highest stated liking for cooking and home-production of meals. Appendix A gives full details.

3.4 Panel data on restaurant visits

We use the LISS panel from CentERdata at Tilburg University to collect measures of household income allocations to restaurants and eating out versus purchasing daily groceries.[8] The LISS panel consists of 4,500 households, comprising 7,000 individuals. The panel tracks consumers

[8]LISS stands for Longitudinal Internet Studies for the Social Sciences. See https://www.lissdata.nl for data access and explanation of the variables collected.

starting in 2007 and is representative for the Netherlands.[9] Panelists complete a questionnaire every month and are paid for participation.

The LISS panel fields different questionnaires monthly, quarterly, and incidentally. The core data are collected monthly and include demographics, such as age and income, and life events such as retirement or unemployment. As part of the LISS data base, the Tilburg Consumer Outlook Monitor (TILCOM) is a quarterly survey that measures consumer attitudes, purchasing, and consumption behavior. This survey was started in the 3^{rd} quarter of 2009, and we have data until the final quarter of 2017. We use the TILCOM data to define a measure of household substitution between groceries and restaurants. In particular, using a 7-point scale, the survey asks a household whether it spends more or less on restaurants and eating out relative to its typical expenditures in the past. The end points of the scale have the interpretation of "a lot less" (coded as a 1) and "a lot more" (coded as a 7). In similar fashion, households are asked to rate whether they spend more or less money on daily groceries relative to typical historical expenditure. Treating the responses to these questions as interval scaled, we next define the difference between the scores on the two questions as a qualitative measure of reallocating resources from grocery purchasing to restaurant visits. Negative scores indicate a reallocation in the direction of grocery expenditure and positive scores in the direction of more intense use of restaurants for food purchases.

Using these data in a regression framework, while allowing for demographic changes and household fixed effects, enables us to estimate the causal effects of retirement and unemployment events on restaurant expenditures, daily groceries, and a household's reallocation between them.

[9]The panel does not select on Internet access, i.e., households are provided with a computer and Internet connection if it prevents them from participation.

4 Empirical analysis

4.1 Empirical strategy

Our empirical analysis uses within-household variation in time budgets that is driven by retirement and unemployment to study the causal effect of time availability on household purchase behavior. The underlying idea is that when the first person retires or becomes unemployed, more time is available that can be used for shopping around and making purchases (see, e.g., Aguiar and Hurst, 2005) and for home production. Alternatively, one can think of the opportunity cost of time as being affected by these labor market events.

We focus on the effects of retirement and unemployment on the three types of purchase outcomes defined above: (1) the number of shopping trips and the number of retailers visited, (2) total grocery purchases in terms of volume, variety, expenditure and expenditure when we re-calculate it using average prices, (3) the extent to which households buy time- and goods-intensive products. Throughout, we control for heterogeneity across households by means of household fixed effects. For (3), we also account for category fixed effects.

Our empirical approach is to follow households over time and to estimate the effect of events that shift the available time. To illustrate this with some model-free evidence, we plot in Figure 1 the total expenditure on grocery items as a function of age and retirement status. The overall trend in age is mildly negative. The older the household head, the lower the overall expenditure on groceries becomes. The gradient is a reduction of about €20 of annual expenditure per year of age. At first glance this seems consistent with the finding by Aguiar and Hurst (2005) that the elderly shop for low prices and therefore spend less. However, unlike Aguiar and Hurst (2005), our data allow us to look at expenditure as a function of retirement while holding age constant. In the raw

data, we observe that –within the age range of 61-65– retirement is associated with households actually spending about €300 more on food items; a difference of about 10% of their annual food expenditure.

–insert Figure 1 here–

An obvious disadvantage of this motivating example is that the figure represents mostly cross-sectional variation and misses proper controls for existing preferences and time trends. We therefore turn to a regression framework next.

4.2 The relationship between available time and shopping activity

Households' shopping activities are informative about the way consumers use the market as a distribution system. A household's available time may restrict the number of shopping trips it can afford and/or the number of stores it visits per shopping trip. At the same time, changes in the labor market status are directly related to changes in the time that is available for home production. For that reason, understanding the dependence of household purchase behaviors on labor market status has important implications for modern retailers' policies on reducing the time cost associated with shopping trips and to understand the competition caused by multi-store shoppers.

We specify

$$y_{it} = \alpha_i + x_{it}\beta + z_{it}\gamma + \delta_t + \varepsilon_{it}, \tag{1}$$

with ε_{it} independent across households $i = 1, ..., N$ and $t = 1, ..., T$ denoting time. The dependent variable y_{it} is an outcome such as the number of shopping trips or the number of retailers visited. The coefficient α_i is a household-specific fixed effect. The vector x_{it} contains the two indicators for whether or not there is at least one retired or unemployed person in the household, respectively.

The vector z_{it} contains observed demographic characteristics for each household-year, i.e., the age of the household head and the number of adults, children, and babies and toddlers, respectively. We use year dummies to control for time effects δ_t. Those could stem from supply side changes that may affect households' shopping activities, e.g., more retailer branches or the availability of online channels.

Observing demographic characteristics helps us separate the effects of changes in labor market status, which operate through a shift in the time budget, from the effects of age and changes in household composition. We assume that labor market events are strictly exogenous (in the sense that they are not related to ε_{it} for any t) once we control for demographics, time- and household fixed effects. This assumption holds when the decision to retire or cease market work is not motivated by a change in the preference for home production and shopping. In the Netherlands, retirement is often mandatory and takes place at an age that is set in a collective labor agreement and that holds in principle for all workers subject to that agreement in the same way (e.g., in most professions the retirement age is considered to be 65). Under this exogeneity assumption, we can take the estimates of β as causal.

Table 5 shows how time availability affects the number of shopping trips made by a household. We view the number of shopping trips as a measure of the willingness to incur travel costs to access the market goods. The first column of Table 5 shows that increased time availability leads to more shopping trips. On average, the retirement of at least one person leads to 4 additional shopping trips per year, whereas unemployment raises the number of shopping trips per year by 4.9. The second column of Table 5 shows that retirement strongly increases the number of retailer visits by about 7.4 a year. Unemployment has a large effect (4.7), but the estimate is relatively noisy and is insignificant. Finally, as can be seen in the third column, the increased availability of time due

to retirement is also associated with visiting a more diverse set of retailers. The same is not true for households in which at least one member is unemployed, who seem to stick to the same stores after unemployment than before.

–insert Table 5 here–

Taken together, we conclude from this that more time available due to retirement or unemployment leads to households making more shopping trips and that retirement leads to more retailer visits and patronage to a more diverse set of retailers.

4.3 The relationship between available time and overall grocery purchases

We now turn to the effect of changes in time availability on home production of meals. To recall, there are two types of related dependent variables we are interested in: in this subsection, we study how time availability affects the quantity of grocery purchasing; in the next subsection, we study shifts in the time intensity of the basket of goods that the consumer purchases.

Producing meals at home requires spending time learning about recipes, and cooking. We therefore expect a positive change in the availability of time to positively affect both the incidence and the variety of home produced meals. We measure household overall food-related grocery purchases by total household expenditure and by the amount of variety purchased. Our findings relate to, yet complement, Aguiar and Hurst (2005), who find that expenditure declines with retirement status, while time spent on food production dramatically increases. Their analysis exploits cross-sectional data with rich demographic information and household expenditure in the restaurant. We complement their findings by exploiting the panel nature of our data, which allow us to make a causal interpretation of the effect of retirement and unemployment. The effect of time availability

on expenditures is theoretically ambiguous as households may increase producing meals at home, yet also spend time finding lower prices. This would mean that there is a positive effect of time availability on quantities and a negative effect on price.

We rely again on the specification (1) described above. Now, the dependent variables are measures of volume, variety, expenditure, and expenditure re-calculated at average prices for the given quantities bought, averaging over time and retailers (as in Aguiar and Hurst, 2007a). Table 6 shows that retirement leads to households buying 3.7% ($= 100 \times \left(e^{0.036} - 1\right)$) more volume in equivalent units (see table notes for details), an extra 10.4 SKU's of variety, and 4.2% ($= 100 \times \left(e^{0.041} - 1\right)$) higher spending. Interestingly, the effect on re-calculated spending is estimated to be virtually the same, and in that sense price shopping is not an important phenomenon in our data.

–insert Table 6 here–

In contrast to the corresponding results for retirement, we find no significant effect of unemployment on these measures, although the sign of the effects is consistently positive. This may be due to heterogeneity in unemployment duration (which we do not observe). A short-term unemployment household might spend a substantial amount of time on searching for a new job, while a long-term unemployment household's overall time allocation decisions may not be very different from a retiree. This explains what we observe in Table 6 – the same sign but smaller and insignificant effects.

To provide a more complete interpretation on the effect of retirement on overall grocery expenditure, we use the LISS/TILCOM data. In particular, using the regression specification (1) again, we study the effect of retirement and unemployment on *changes* in expenditure on eating out in restaurants. Table 7 shows the regression results for the qualitative measures of restaurant expen-

diture, grocery expenditure, and the reallocation between them. An increase in the amount of time that is available due to retirement leads to a larger decrease in spending in restaurants and a larger increase in spending on daily groceries. Thus, the availability of additional time from retirement leads households to increasingly substitute away from eating out. We also find that unemployment leads to a larger decrease of expenditure on eating out, but also a larger self-reported decrease of grocery expenditure. This negative effect on self-reported spending could, however, reflect that unemployed households have the same overall spending (see Table 6) while going on more trips (see Table 5), meaning that spending per trip actually decreases.

–insert Table 7 here–

Taken together, the evidence from the GfK and LISS panels suggests that retirement leads to a substitution from market produced food options to more home produced food options. The findings for unemployment are less conclusive. One possible explanation is that unemployment duration varies across households. A short-term unemployment household may spend time searching for jobs and still be time constrained, while a long-term unemployment household's overall time allocation decisions may not be very different from a retiree. This would predict that the unemployment effect is a mix of a null effect and similar results as observed with retirement. This, in turn, is consistent with what we observe. Moreover, individuals who are unemployed will likely spend time on finding a new job. All this makes it harder to find systematic and consistent patterns.

We continue by investigating whether within the more time intensive food options (i.e., within grocery purchases) there is a shift into more time intensive varieties.

4.4 The relation between available time and household product type preference

Discretionary time does not only influence the overall quantity of a household's overall purchases, but may also affect the type of products a household prefers to buy. We hypothesize that a household is likely to switch to more time intensive substitutes within a category when it faces an increase in available time. As described in more detail in Section 3.3, we classify sub-categories as time-intensive or not within each selected category and then aggregate the data to one observation per household, year, category, and degree of time intensity (thus 5 times 2 for each household and year). We then specify

$$y_{ikst} = \alpha_i + \alpha_k + (\beta + \theta d_s)\, x_{it} + \gamma z_{it} + \delta_t + \eta d_s + \varepsilon_{ikst}, \tag{2}$$

where k denotes the category. d_s is a binary variable that indicates whether a subcategory is relatively time-intensive or not within a given category. y_{ikst} is the log of household i's expenditure in subcategory s, category k, and time period t. As before in (1), x_{it} is a vector of household time budget shifters: whether or not at least one household member is retired or unemployed, respectively, and z_{it} is a vector of observed demographic information that may influence a household's grocery shopping decisions. Also as before, we use year dummies, δ_t, to proxy the supply side changes that may affect households' shopping activities, e.g., more retailer branches and retailer adoption of online channel. We further control for household (α_i) and category (α_k) fixed effects and for differences in the inclination to buy time intensive goods, η. The parameter θ measures the causal impact of a time-shifting event on purchasing time intensive varieties in a category. This is the parameter of interest in this subsection.

Table 8 presents the percentage change in a household's purchase volume on time-intensive sub-categories within each category. The estimates suggest that retirement leads to an expenditure drop in goods intensive varieties of -17.7% ($= 100 \times \left(e^{-0.195} - 1\right)$) and an increase in volume for time intensive goods of 30.1% ($= 100 \times \left(e^{-0.195+0.458} - 1\right)$). This means that households substitute to time-intensive goods when the time budget increases from retirement. Note that these effects are consistent with an overall increase of expenditures in meal-related market goods, discussed in the previous section. First of all, the increase in volume of time-intensive goods is larger than the decrease in volume of more convenient versions of these goods. Second, time-intensive goods account for about 2/3 of all expenditures in these categories (see Section 3.3).

–insert Table 8 here–

The other three columns show similar patterns for variety within category, spending, and spending at average prices. This means that across all measures of purchase activity, retirement is associated with intra-category substitution into time intensive varieties. This complements the results in Aguiar and Hurst (2005, 2007a) who do not address product-type choice or within category substitution. In the previous section, we found that retirees shop more, but not necessarily for lower prices and that their total food expenditure rises. In this section, we find that upon retirement, households switch into more time intensive varieties. Although speculative, this finding is consistent with the use of time to achieve quality improvements in home production by using more ingredients that can be processed fresh at home. Table 3 rules out that retirement status is associated with a preference shift for cooking, so we attribute the behavioral shift to the availability of more time.

Table 3 also rules out that the results are driven by changes in income, as income is not affected

by retirement for the households in our sample. In fact, this could explain why in our sample total spending increases, while Aguiar and Hurst (2005) document a decrease in spending: U.S. households use time to consume food of similar nutritional value at lower expenditure to compensate for a drop in income, while Dutch households spend more on meals that are produced in a more time intensive way.

For unemployment, the results go in the same direction but are not significant (similar to what we find in Table 6). As before, our explanation for this difference is that retirement is a permanent time shock. In contrast, most people perceive unemployment as a temporary time shock and may not want to incur the cost of changing one's routines.

These results are based on our own classification of time intensity. In Appendix Table A.7 we present results that are based on a data-driven classification. In brief, we classify sub-categories into time-intensive group and non-time-intensive group with observed purchase data and household demographic information. The intuition is that there is positive correlation between a household's willingness to spend time on cooking and its purchases on time-intensive goods. We exploit the cross-sectional variation in household's self-reported willingness to spend time on cooking and purchases and performed similar analysis as Equation (2). The analysis procedure and the results are presented in Appendix A. The conclusions derived from Table A.7 are fully consistent with those in Table 8, discussed above.

5 Concluding remarks

Using individual level survey data and scanner purchase data for a panel of households from 2009 to 2013, we find that there is a strongly positive relationship between a household's available time

and its shopping activity both in terms of the number of shopping trips and the number of retailers visited per trip. Consistent with the time-intensive nature of home-producing food, we also find a positive effect of time availability on total grocery volume, expenditure, and variety. At the same time, we report a negative effect of discretionary time on restaurant expenditures, suggesting that time availability moderates substitution into home production and out of market-provided food services. With respect to substitution between grocery products of different time intensity and price, we find that a household is more likely to switch to time intensive market goods when more time becomes (permanently) available. We show that these effects are not driven by changes in income or other demographics.

We conclude that the consumer takes into account the full cost of consumption goods, i.e., the sum of the price of market goods plus the value of time inputs, when purchasing grocery products. This has implications for (1) innovation in retailing and (2) innovation in the nature of grocery products. First, the effect of time availability on the number of shopping trips supports the idea that retailers can compete for consumers by reducing the time costs associated with purchasing market goods. They can do so for instance by providing an online channel, delivery service, or extended store opening hours.

Second, our findings also speak to how time use affects the direction of innovation in grocery products. Most households in our panel prefer variety and preparing meals themselves using fresh ingredients. Manufacturers and retailers therefore have an incentive to cater to this preference at a low time cost of home production and of discovery of new recipes. Recently, online food retailers have entered the market with a subscription service that curates and delivers a box of fresh ingredients and preparation instructions to households every week. This new way of retailing grocery products to households lowers the total time cost of home producing meals in greater

variety. However, this is not through less time-intensive ingredients, but through the convenience of delivery, low discovery cost of new recipes, and preparation instructions. Existing brick-and-mortar grocery retailers have responded by selling similar meal kits consisting of measured, boxed fresh ingredients in-store, along with preparation instructions. Manufacturers also have innovated into providing more advanced market goods in the sense of requiring less time inputs in home production (e.g., ethnic pre-mixed spices, meal kits, etc.). These innovations are all examples of sellers' forward integration into households' home production.

We see several avenues for extensions that we leave to future research. Among these is studying the extent to which consumer differences in productivity, e.g., experience or skill, form an explanation for heterogeneity in purchases and preferences for market goods. In addition, it is useful to quantify the welfare effects of firms providing lower transaction-, evaluation-, and travel-costs to consumers.

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tition and market power: a model of supermarket pricing," *American Economic Review*, 107, 2308–51.

Table 1: Demographics and stated preferences

	variable	10th percentile	mean	90th percentile	standard deviation	number of households
full sample	age	33.00	52.51	73.00	14.82	6814
	number adults age 19+	1.00	1.89	2.80	0.70	6814
	number children age 5-18	0.00	0.46	2.00	0.85	6814
	number babies/toddlers age 0-4	0.00	0.13	0.50	0.39	6814
	price shopping preference	7.40	10.59	13.50	2.35	6814
	cooking preference	6.40	9.67	13.00	2.43	6814
	number of years observed	*1.00*	*3.46*	*5.00*	*1.52*	*6814*
balanced sample	age	41.00	58.01	75.00	12.75	2602
	number adults age 19+	1.00	1.90	2.80	0.68	2602
	number children age 5-18	0.00	0.34	1.60	0.74	2602
	number babies/toddlers age 0-4	0.00	0.04	0.00	0.19	2602
	price shopping preference	7.40	10.51	13.20	2.23	2602
	cooking preference	6.40	9.45	12.40	2.31	2602
	number of years observed	*5.00*	*5.00*	*5.00*	*0.00*	*2602*

Note: Reported descriptive statistics are first taken over years and then households. Only complete observations were considered. Households in the balanced sample are observed in all five years, 2009 to 2013. Age is for the household head. For cooking and shopping preferences, we report statistics for indices calculated from three questions by summing up respective numbers indicating the degree to which participants disagreed with the statement on three five-point Likert scales for each preference. The three questions for price shopping preferences are asking how much participants *disagree* with the statements "I first look at the price when I go grocery shopping", "I always watch out for offers", and "before buying something I usually check whether I can buy it cheaper elsewhere". We converted this to *agreement* with the statements by taking the negative of the likert score and adding 6. The three statements that are used to elicit cooking preferences are "a housewife/househusband shouldn't spend hours in the kitchen", "I actually don't like cooking", and "I prefer to stick to cooking familiar dishes". Higher values of the indices thus indicate the degree of deal sensitivity and of willingness to spend time and effort on cooking.

Table 2: Labor market status, time use, and income

variable	10th percentile	mean	90th percentile	standard deviation overall	between	within	number obs.
either household head or partner retired	0.00	0.29	1.00	0.45	0.42	0.11	23575
either household head or partner unemployed	0.00	0.04	0.00	0.19	0.18	0.10	23575
hours work at home household head and partner	8.00	24.81	44.00	14.67	14.07	5.34	23570
hours market work household head and partner	21.50	51.27	80.00	22.80	21.33	8.97	16021
net monthly household income	1000	2177	3400	891	847	344	23575

Note: Descriptive statistics for the full household panel and for the years 2009 to 2013. The first two variables are indicators, the third and the fourth are the sum across household members for a typical week, respectively, and income is in nominal euros. The overall standard deviation is across all observations in the full sample. The between standard deviation is across the respective individual means. The within standard deviation is across obervations after we have removed individual-specific means.

Table 3: The effect of retirement and unemployment on time use, income, and preferences

variable	weekly hours work at home	weekly hours market work	log income	price shopping preferences	cooking preferences
retired	0.401	-20.939	-0.003	0.154	0.105
	(0.436)	(1.676)	(0.015)	(0.086)	(0.082)
unemployed	0.844	-26.279	-0.007	0.349	0.011
	(0.469)	(1.199)	(0.014)	(0.097)	(0.093)
age household head	0.006	0.562	0.014	-0.019	0.003
	(0.060)	(0.181)	(0.004)	(0.016)	(0.016)
number adults age 19+	5.244	18.296	0.051	0.138	-0.012
	(0.227)	(0.689)	(0.008)	(0.044)	(0.046)
number children age 5-18	4.634	6.048	0.028	0.040	-0.120
	(0.312)	(0.629)	(0.009)	(0.049)	(0.054)
number babies/toddlers age 0-4	2.711	3.730	0.038	-0.084	-0.116
	(0.403)	(0.597)	(0.014)	(0.080)	(0.081)
household fixed effects	✓	✓	✓	✓	✓
time fixed effects	✓	✓	✓	✓	✓
within-household R^2	0.054	0.340	0.037	0.026	0.013
num. household-year obs.	23570	16021	23575	23575	23575

Note: Standard errors clustered at the household level in parentheses. Log income is the log of nominal monthly net household income. The two preference variables measure the responsiveness to price promotions and the preference for spending time on cooking, respectively. See notes to Table 1 for more information on the definition of the respective dependent variable and the underlying questions. Retired means that either the household head or his or her partner is retired. Likewise for unemployed.

Table 4: Shopping behavior

variable	10th percentile	mean	90th percentile	standard deviation
number of trips	51	131	234	72
number of retailer visits	61	187	354	124
number of unique retailers visited	5	15	27	8
volume in equivalent units	359829	992241	1778000	579612
number of varieties	302	627	995	272
expenditure	1104	2791	4760	1475
expenditure on selected categories	250	778	1390	477
expenditure on time intensive products	139	510	958	344
expenditure on goods intensive products	87	267	485	168

Note: Reported descriptive statistics are taken over households in the full unbalanced panel and years 2009 to 2013. The number of trips refers to the trips per year, whereby a trip is defined as a unique combination of household identifier, purchase date, and day-part. The number of retailer visits is the number of unique combinations of retailer identifier, date, and day part. The number of unique retailers visited is the total number of unique retailers visited during the year. Volume is in equivalent units, meaning that we see one millimeter comparable to one gram and take the sum over those by household and year. The number of varieties refers to the number of unique food items at the stock keeping unit level in a household's annual shopping basket. Expenditure refers to a household's yearly overall expenditure on all the grocery goods and is measured in euros. Expenditure on selected categories refers to expenditure on fish and seafood/shellfish, fruit, meat, potatoes, and vegetables. This is split up into expenditure on respectivly time and goods intensive producs (see Section 3.3 and Table A.2).

Table 5: The effect of retirement and unemployment on shopping trips

variable	trips	retailer visits	unique retailers
retired	4.015	7.446	1.003
	(1.430)	(2.470)	(0.197)
unemployed	4.896	4.654	0.072
	(1.632)	(2.568)	(0.210)
log income	0.272	1.269	0.250
	(0.982)	(1.564)	(0.145)
age household head	0.620	0.863	0.031
	(0.390)	(0.650)	(0.056)
number adults age 19+	5.480	8.421	0.046
	(0.870)	(1.395)	(0.110)
number children age 5-18	5.088	7.925	-0.157
	(1.067)	(1.788)	(0.132)
number babies/toddlers age 0-4	7.225	9.702	0.201
	(1.507)	(2.510)	(0.208)
household fixed effects	✓	✓	✓
year fixed effects	✓	✓	✓
within-household R^2	0.078	0.078	0.077
num. household-year obs.	23575	23575	23575

Note: Standard errors clustered at the household level in parentheses. One observation is one household in one year. The number of trips refers to the trips per year, whereby a trip is defined as a unique combination of household identifier, purchase date, and day-part. The number of retailer visits is the number of unique combinations of retailer identifier, date, and day part. The number of unique retailers visited is the total number of unique retailers visited during the year. Retired means that either the household head or his or her partner is retired. Likewise for unemployed.

Table 6: The effect of retirement and unemployment on grocery purchases

variable	log volume	variety	log euros	log euros av. pr.
retired	0.036	10.376	0.041	0.042
	(0.012)	(4.782)	(0.010)	(0.010)
unemployed	0.018	6.801	0.017	0.019
	(0.014)	(6.065)	(0.014)	(0.014)
log income	0.047	14.706	0.053	0.051
	(0.011)	(3.946)	(0.010)	(0.010)
age household head	0.016	3.147	0.015	0.014
	(0.003)	(1.215)	(0.003)	(0.003)
number adults age 19+	0.140	40.534	0.117	0.112
	(0.008)	(3.707)	(0.008)	(0.008)
number children age 5-18	0.143	44.155	0.107	0.102
	(0.010)	(4.949)	(0.010)	(0.009)
number babies/toddlers age 0-4	0.116	41.079	0.093	0.088
	(0.015)	(7.542)	(0.015)	(0.015)
household fixed effects	✓	✓	✓	✓
year fixed effects	✓	✓	✓	✓
within-household R^2	0.138	0.066	0.067	0.067
num. household-year obs.	23575	23575	23575	23575

Note: Standard errors clustered at the household level in parentheses. One observation is one household in one year. Volume is in equivalent units, meaning that we see one millimeter comparable to one gram and take the sum over those by household and year. The number of varieties refers to the number of unique food items at the stock keeping unit level in a household's annual shopping basket. Expenditure refers to a household's yearly overall expenditure on all the grocery goods and is measured in euros. Euros at the average price are calculated by first calculating the average price at the SKU level per year and then multiplying the purchased quantities by this average price before summing over all purchases for one household and one year. Logs are taken after adding one to the yearly quantity. Retired means that either the household head or his or her partnet is retired. Likewise for unemployed.

Table 7: The effect of retirement and unemployment on grocery versus restaurant expenditure

variable	stated restaurant expenditure		stated grocery expenditure		difference in expenditure	
retired	-0.047	-0.080	0.068	0.061	-0.126	-0.162
	(0.041)	(0.042)	(0.027)	(0.028)	(0.041)	(0.042)
unemployed	-0.342	-0.337	-0.267	-0.255	-0.051	-0.067
	(0.046)	(0.048)	(0.039)	(0.040)	(0.041)	(0.043)
log income		0.317		0.235		0.081
		(0.045)		(0.033)		(0.042)
college degree(y/n)		-0.137		-0.079		-0.081
		(0.087)		(0.062)		(0.094)
number of hh members		-0.114		0.005		-0.112
		(0.026)		(0.022)		(0.030)
age hh head		-0.004		0.003		-0.003
		(0.011)		(0.007)		(0.009)
household fixed effects	✓	✓	✓	✓	✓	✓
year-quarter effects	✓	✓	✓	✓	✓	✓
within-household R^2	0.026	0.030	0.010	0.015	0.013	0.013
num. household-year obs.	44571	41116	40774	37558	40774	37558

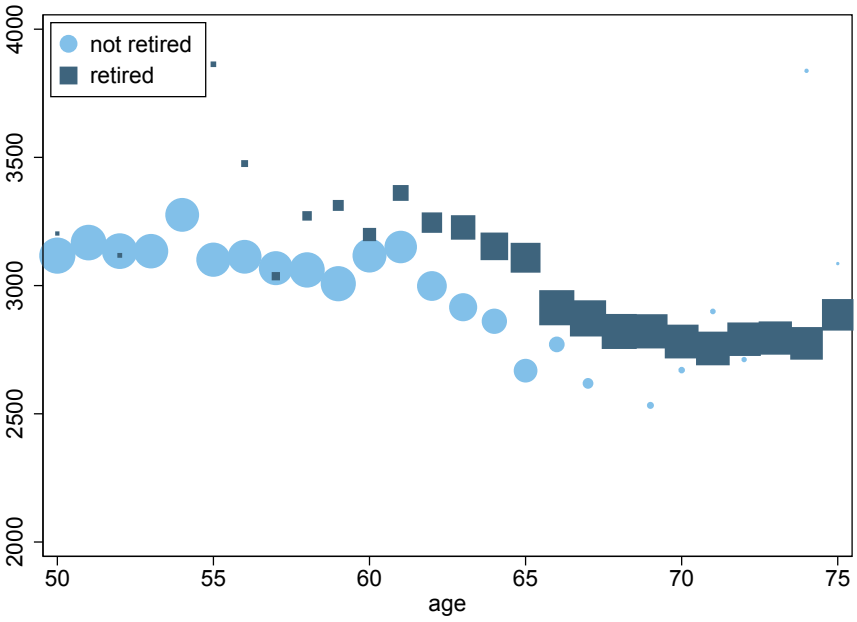
Note: Standard errors clustered at the household level in parentheses. Restaurant expenditure is measured on 7 point scales as an answer to the question "Compared to what I did before (last quarter), I spent [x] money on eating out." In this question "x" stands for 1. Much less, 2. Less, 3. A little less, 4. Just as much, 5. A bit more, 6. More, and 7. Much more. Grocery expenditure is measured in the same way using the question "Compared to what you did before, in the last six months I spent [x] money on daily groceries. The difference in expenditure is measured as the difference between restaurant expenditure score and the grocery expenditure score. Income is net monthly household income.

Table 8: The effect of retirement and unemployment on time intensity of shopping basket

variable	log volume	variety	log euros	log euros av. pr.
retired	-0.146	-0.902	-0.195	-0.197
	(0.037)	(0.175)	(0.017)	(0.017)
unemployed	0.009	-0.048	0.027	0.024
	(0.053)	(0.256)	(0.025)	(0.024)
retired $\times$ time-intensity	0.287	2.360	0.458	0.468
	(0.040)	(0.162)	(0.018)	(0.018)
unemployed $\times$ time-intensity	0.054	0.494	0.001	0.015
	(0.073)	(0.333)	(0.032)	(0.032)
log income	0.092	0.451	0.065	0.061
	(0.027)	(0.124)	(0.012)	(0.012)
age household head	0.023	0.088	0.017	0.016
	(0.008)	(0.037)	(0.004)	(0.004)
number adults age 19+	0.167	1.045	0.119	0.111
	(0.020)	(0.108)	(0.010)	(0.009)
number children age 5-18	0.109	0.533	0.079	0.073
	(0.024)	(0.149)	(0.011)	(0.011)
number babies/toddlers age 0-4	0.072	0.623	0.066	0.061
	(0.035)	(0.222)	(0.017)	(0.017)
household fixed effects	✓	✓	✓	✓
year fixed effects	✓	✓	✓	✓
subcategory fixed effects	✓	✓	✓	✓
within-household R^2	0.311	0.621	0.548	0.554
num. household-year obs.	235750	235750	235750	235750

Note: Standard errors clustered at the household level in parentheses. We classify products into time-and goods intensive within five categories (see Table A.2). There are 10 observations per household and year, one for time-intensive products and one for goods-intensive produces, in the five selected categories, respectively. Note that we control for subcategory fixed effects. Retired means that either the household head or his or her partnet is retired. Likewise for unemployed.

Figure 1: Grocery Expenditure on Food



Note: This figure shows the yearly spending on food items by age and retirement status. Retired is defined as either the household head or her partner being retired. The size of each marker corresponds to the number of observations that was used. Outliers for some young retirees or old workers (i.e., some small-sized markers) are not represented to show detail in the range between 55 and 70 (which is fully represented). Calculated for the full, unbalanced, sample. The graph is highly similar with the data from the balanced subsample.

A Alternative method of measuring time-intensity

We form a time-intensity index for each sub-category in a given category by projecting the household willingness to spend time on cooking on the expenditures on various categories.[10] The intuition is that there is a relationship between a household's willingness to spend time on cooking and the composition of its expenditure on various categories.

We estimate our time-intensity index for each sub-category κ in a category k using the following specification:

$$h_i = \phi_0 + \phi_\kappa q_{i\kappa} + z_i + \varepsilon_i, \tag{A.1}$$

with ε_i i.i.d. across i. h_i is a household's self-stated willingness to spend time on cooking. h_i is standard 5-scale rating outcome—higher value of h_i means high willingness to spend time on cooking. z_i are household demographics like household size, marital status, breadwinner education level, ownership of microwave and dish-washer. $q_{i\kappa}$ is household i's expenditure in sub-category κ. ϕ_κ is the time-intensity index for each sub-category κ. A subcategory is time-intensive if ϕ_κ is positive. If ϕ_κ is negative, the sub-category is defined as non-time-intensive.

We next aggregate, within category k, the total purchase activity in time intensive and non-time intensive categories. We then investigate the relation between a household's available time and its expenditure on time-intensive categories versus non-time-intensive categories. We then estimate equation (2) to replicate the analysis reported in table 8. The results are reported in Table A.7. The results are highly consistent with Table 8.

[10] The original survey asks "Een huisvrouw/ huisman moet geen uren in de keuken staan", which means "A housewife / houseman does not have to stand in the kitchen for hours". The rating is from 1 to 5 with 1 equals to strongly agree and 5 equals to strongly disagree. Therefore, 5 can be interpreted as high willingness to spend time on cooking while 1 is low willingness to spend time on cooking.

Table A.1: Top categories in GfK Panel

rank	category name	euros	units	vol
1	meat	8709153.15	3.3e+06	6.90e+08
2	alcoholic beverages	6679691.06	6.2e+06	2.62e+09
3	vegetable	6461696.15	6.4e+06	2.02e+09
4	non alcoholic drinks	5381460.23	8.9e+06	7.42e+09
5	bread	5376452.82	1.3e+07	2.29e+09
6	fruit	5090985.31	6.8e+06	1.54e+09
7	cold cuts	4946690.47	3.3e+06	3.45e+08
8	cheese	4897526.16	2.2e+06	3.38e+08
9	milk and dairy drinks	3416028.85	5.3e+06	4.53e+09
10	milk products	3212314.1	4.6e+06	2.25e+09
11	cookies	3147148.45	3.3e+06	7.55e+08
12	hot drinks	3106802.23	1.4e+06	3.33e+08
13	savory snacks	2597282.64	2.9e+06	4.34e+08
14	chicken and poultry	2447846.79	875424	1.72e+08
15	meals	2373815.99	1.2e+06	4.24e+08
16	fish and seafood/shellfish	2134080.33	783729	1.84e+08
17	edible oils and fats	2109068.91	1.7e+06	7.93e+08
18	potatoes	1856750.18	1.2e+06	1.66e+09
19	sugar confectionery	1518659.61	1.7e+06	2.66e+08
20	chocolate	1506054.16	1.1e+06	2.03e+08

Note: Top 20 and revenue rank of highest selling categories. Of these we choose the largest meal components: meat, vegetable, fruit, fish and shellfish, and potatoes. The table lists aggregates across all households and time periods in the GfK household panel data.

Table A.2: Time-intensity classification of product groups

category and subcategory name	examples of products	classification	category and subcategory name	examples of products	classification
fish and shellfish			**potatoes**		
canned fish	tuna in water; marinated herring	goods intense	frozen potato products	potato fries pre-fried; pre-cut fries	Goods Intense
canned crustaceans	mussels; mussels in vinegar	goods intense	potato products	mini potato stick; pre-cooked mini potato	Goods Intense
canned invertebrates	caviar	goods intense	frozen mashed potatoes	frozen mashed potato	Goods Intense
frozen fish	seasoned salmon ; microwavable fish ; breaded fish fingers	time intense	mashed potatoes	instant mashed potato	Goods Intense
fresh fish	herring	time intense	canned potato products	chile potato; potato gratin	Goods Intense
fresh crustaceans	mussels with shell; shrimp	time intense	potatoes peeled	potato peeled	Goods Intense
frozen crustaceans	shrimp ball; peeled shrimp	time intense	potatoes unpeeled	potatoes unpeeled	Time Intense
frozen invertebrates	breaded squid rings fried; french vine snails with herb butter	time intense			
fresh invertebrates	snails in garlic butter; grilled octopus	time intense	**vegetable**		
			conserved ginger	ginger (jar)	Goods Intense
fruit			frozen vegetable snacks	vegetable croquette; 2. vegetable spring rolls	Goods Intense
apples	various apple	goods intense	mixed vegetable	stir fry mix; broccolimix	Goods Intense
pears	various pear	goods intense	frozen mixed vegetable	mexican vegetable mix; italian vegetable mix	Goods Intense
dried fruit	variety of dried southern fruit; olive	goods intense	canned mushrooms	mushroom slices in jar; mushroom discs in pot	Goods Intense
fruit compote	apple sauce; green apple spices pot	goods intense	frozen mushrooms	frozen sliced mushroom	Goods Intense
fruit edited fresh	pineapple pieces; blueberry	goods intense	canned tomatoes	tomato paste; tomato puree	Goods Intense
frozen fruit	frozen summer fruit; frozen blueberry	goods intense	frozen vegetables	frozen spinach; frozen peas	Goods Intense
fruit large otherwise	kiwi; banana	goods intense	conserved vegetable	sweet corn; green bean	Goods Intense
fruit mix-salads	fresh fruit salad	goods intense	fresh vegetable snacks	indian spinach pakora bake; indian vegetarian samosas	Goods Intense
canned fruit	fruit cocktail ; peach in syrup; pineapple pieces in sugar	goods intense	cabbage	cauliflower; sprout	Time Intense
fruit small else	strawberry; white grapes; cherry	goods intense	dried mushrooms	dried mushroom	Time Intense
ready-ready pie filling	cherry pie filling; 2. strawberry pie filling	goods intense	greens	endive; iceberg lettuce	Time Intense
canned southern fruit preserves	capers; black olives	time intense	legumes	green bean	Time Intense
citrus fruits otherwise	mandarin	time intense	fresh mushrooms	fresh mushroom; sliced fresh mushroom	Time Intense
coconuts	whole coconut; coconut box	time intense	paprika	variety of pepper	Time Intense
grapefruits	variety of grapefruit	time intense	other vegetable	broccoli; cucumber	Time Intense
oranges	variety of orange	time intense	dried vegetables	split peas	Time Intense
meat					
frozen meat snacks	meatloaf ;	goods intense			
frozen meat substitutes	veggie sate stuck; vegan chicken piece	goods intense			
frozen meat mixed	hamburger frozen	goods intense			
canned meat	liver paste; meat snack	goods intense			
meat snacks	ham cheese tapas; pre-processed meat snack	goods intense			
smoked sausage	smoked sausage	goods intense			
frozen smoked sausage	frozen smoked sausage	goods intense			
raw pork	raw pork	time intense			
frozen meat other	frozen seasoned lamb meat	time intense			
frozen beef	beef ready to cook; beef w. onion ready to cook; beef steak	time intense			
raw beef	fresh beef	time intense			
raw minced meat	beef chopped	time intense			
mixed meat	mixed meat	time intense			
meat substitutes	cheese souffle; vegetarian burger	time intense			
canned meat substitutes	seitan	time intense			
frozen minced meat	beef; soup meatball	time intense			
raw other meat	other fresh meat	time intense			
frozen pork	spare ribs; schnitzel pork	time intense			

Note: This table presents the UPC-directory names of the UPCs with highest sales for each sub-category. If the top three UPCs have identical product names, then we only present the top one or top two.

Table A.3: Specification check: the effect of the number of retired and unemployed household members on grocery purchases

variable	log volume	variety	log euros	log euros av. pr.
number retired	0.039	13.154	0.045	0.045
	(0.009)	(3.471)	(0.007)	(0.007)
number unemployed	0.015	7.629	0.020	0.021
	(0.012)	(5.452)	(0.012)	(0.012)
log income	0.046	14.496	0.052	0.050
	(0.011)	(3.945)	(0.010)	(0.010)
age household head	0.015	3.052	0.015	0.014
	(0.003)	(1.210)	(0.003)	(0.003)
number adults age 19+	0.138	39.973	0.115	0.110
	(0.008)	(3.708)	(0.008)	(0.008)
number children age 5-18	0.142	43.814	0.106	0.101
	(0.010)	(4.953)	(0.010)	(0.009)
number babies/toddlers age 0-4	0.115	40.801	0.092	0.088
	(0.015)	(7.542)	(0.015)	(0.015)
household fixed effects	✓	✓	✓	✓
year fixed effects	✓	✓	✓	✓
within-household R^2	0.138	0.067	0.068	0.068
num. household-year obs.	23575	23575	23575	23575

Note: Note: See note to Table 6. Here we use the number of retired and unemployed household members, respectively, instead of the indicator for there being at least one retired or unemployed household member.

Table A.4: Specification check: the effect of retirement and unemployment on grocery purchases without controlling for income

variable	log volume	variety	log euros	log euros av. pr.
retired	0.036	10.336	0.041	0.042
	(0.012)	(4.772)	(0.010)	(0.010)
unemployed	0.018	6.700	0.017	0.018
	(0.014)	(6.061)	(0.014)	(0.014)
age household head	0.016	3.358	0.016	0.015
	(0.003)	(1.223)	(0.003)	(0.003)
number adults age 19+	0.142	41.285	0.120	0.114
	(0.008)	(3.724)	(0.008)	(0.008)
number children age 5-18	0.144	44.563	0.108	0.103
	(0.010)	(4.973)	(0.010)	(0.010)
number babies/toddlers age 0-4	0.118	41.644	0.095	0.090
	(0.016)	(7.589)	(0.015)	(0.015)
household fixed effects	✓	✓	✓	✓
year fixed effects	✓	✓	✓	✓
within-household R^2	0.136	0.065	0.064	0.065
num. household-year obs.	23575	23575	23575	23575

Note: See note to Table 6. Here we additionally control for the log of net monthly household income.

Table A.5: The effect of retirement and unemployment on grocery purchases for selected categories

	log volume	variety	log euros	log euros av. pr.
retired	0.019	2.783	0.051	0.053
	(0.016)	(1.548)	(0.013)	(0.013)
unemployed	-0.018	1.986	0.020	0.022
	(0.024)	(2.000)	(0.019)	(0.018)
log income	0.048	4.506	0.059	0.056
	(0.015)	(1.238)	(0.013)	(0.013)
age household head	0.014	0.877	0.017	0.015
	(0.004)	(0.366)	(0.004)	(0.004)
number adults age 19+	0.128	10.448	0.118	0.104
	(0.010)	(1.085)	(0.009)	(0.009)
number children age 5-18	0.107	5.332	0.088	0.074
	(0.013)	(1.488)	(0.011)	(0.011)
number babies/toddlers age 0-4	0.081	6.229	0.079	0.068
	(0.019)	(2.220)	(0.017)	(0.017)
household fixed effects	✓	✓	✓	✓
year fixed effects	✓	✓	✓	✓
within-household R^2	0.028	0.027	0.040	0.038
num. household-year obs.	23575	23575	23575	23575

Note: This table replicates Table 6 for selected categories. These are fish and seafood/shellfish, fruit, meat, potatoes, and vegetables.

Table A.6: The effect of retirement and unemployment on additional outcome variables

	any meals	share meals	share time intense	price index	price index sel. cat.
retired	-0.020	0.000	0.001	-0.001	-0.001
	(0.010)	(0.001)	(0.003)	(0.002)	(0.003)
unemployed	-0.004	-0.000	-0.003	-0.001	-0.003
	(0.010)	(0.001)	(0.005)	(0.002)	(0.003)
age household head	-0.000	-0.000	0.003	0.002	0.003
	(0.007)	(0.001)	(0.003)	(0.001)	(0.002)
log income	0.002	-0.000	0.001	0.001	0.001
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
number adults age 19+	0.009	-0.001	0.003	0.005	0.013
	(0.004)	(0.001)	(0.002)	(0.001)	(0.002)
number children age 5-18	-0.003	-0.001	0.000	0.005	0.015
	(0.003)	(0.001)	(0.002)	(0.001)	(0.002)
number babies/toddlers age 0-4	-0.005	0.004	0.002	0.004	0.011
	(0.004)	(0.001)	(0.003)	(0.002)	(0.003)
household fixed effects	✓	✓	✓	✓	✓
year fixed effects	✓	✓	✓	✓	✓
within-household R^2	0.002	0.004	0.005	0.010	0.007
num. household-year obs.	23575	23575	23575	23575	23575

Note: Standard errors clustered at the household level in parentheses. Any meals is an indicator for purchasing any ready-made meals. Share meals is the expenditure share for meals. Share time intense is the share of time-intense products, according to our classification (see Table A.2). The two price indices are the total amount spent in euros divided by the amount that the household would have paid had he purchased the exact same items at the average price. Calculated by first calculating the average price at the SKU level per year and then multiplying the purchased quantities by this average price before summing over all purchases for one household and one year. The second price index is for selected categories, fish and seafood/shellfish, fruit, meat, potatoes, and vegetables. Retired means that either the household head or his or her partnet is retired. Likewise for unemployed.

Table A.7: The effect of retirement and unemployment on time intensity of shopping basked (data-driven classification of subcategories)

variable	log volume	variety	log euros	log euros av. pr.
retired	-0.106	-0.846	-0.086	-0.089
	(0.028)	(0.177)	(0.014)	(0.014)
unemployed	0.071	-0.097	0.023	0.023
	(0.037)	(0.265)	(0.021)	(0.020)
retired× time-intensity	0.265	2.249	0.245	0.255
	(0.029)	(0.166)	(0.015)	(0.015)
unemployed× time-intensity	-0.116	0.590	0.005	0.009
	(0.055)	(0.328)	(0.029)	(0.029)
log income	0.053	0.451	0.049	0.046
	(0.020)	(0.124)	(0.010)	(0.010)
age household head	0.018	0.088	0.014	0.013
	(0.006)	(0.037)	(0.004)	(0.004)
number adults age 19+	0.129	1.045	0.089	0.080
	(0.015)	(0.108)	(0.008)	(0.008)
number children age 5-18	0.115	0.533	0.065	0.057
	(0.019)	(0.149)	(0.009)	(0.009)
number babies/toddlers age 0-4	0.103	0.623	0.057	0.052
	(0.026)	(0.222)	(0.014)	(0.014)
household fixed effects	✓	✓	✓	✓
year fixed effects	✓	✓	✓	✓
subcategory fixed effects	✓	✓	✓	✓
within-household R^2	0.836	0.640	0.828	0.832
num. household-year obs.	235750	235750	235750	235750

Note: This table re-estimates Table 8 on a data set that was constructed by classifying the subcategories in Table A.2 in a data-driven way and then aggegating purchases by household, year, category, and time intensity. To classify the sub-categories, we regress the share of the total budget spent on food in a particular subcategory on the index measuring the willingness to spend time and effort on cooking (see notes to Table 1), whether the household head or her partner is retired, whether the household head or her partner is unemployed, the age of the household head, the number of adults in the household, the number of children age 5-18, and the number of babies and toddlers up to 4 years of age. A subcategory is classified as time intense when the coefficient on cooking preference is positive.