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Submitted Article

How Does Time Poverty Affect Behavior? A Look at Eating and Physical Activity

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Abstract *This paper uses data on daily activities from the American Time Use Survey and the associated Eating & Health Module to analyze the relationships between time poverty and specific energy-balance behaviors. The authors estimate a simultaneous model to jointly analyze the relationships between time poverty and the probability of a fast food purchase, the number of eating and drinking occurrences, minutes spent engaging in sports and exercise, and the probability of engaging in active travel (walking or cycling). Time-poor individuals were found to have different eating and physical activity patterns than non-time-poor individuals; those who were time-poor were less likely to purchase fast food and also less likely to engage in active travel.*

Key words: Time use, Discretionary time, Time poverty, Time-poor, American Time Use Survey, Eating and Health Module, Energy balance, Exercise, Eating patterns, Fast food, Active travel.

JEL codes: I12, J10, I30.

Introduction

Time poverty is defined as not having enough discretionary time. Discretionary time is important for restorative purposes and for investment in one's health and human capital; it is also important for avoiding social exclusion (Bittman 2002). This study defines an individual's daily discretionary minutes by subtracting minutes of necessary and committed time from 1,440 (total daily minutes) as done in Kalenkoski, Hamrick, and Andrews (2011). Necessary activities are those activities that must be performed by an individual for him- or herself (sleep, grooming, health-related self-care, and other personal and/or private activities). Committed activities are those that must be performed due to previous life choices such as whether to marry, to divorce, to have and raise children, and to be employed (time spent in household work, time spent in child care, time

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spent caring for household adults, and time spent in employment or related activities).[1] Although an individual has the ability to make marriage, divorce, fertility, and employment choices over time, on a given day these choices have already been made, and their associated time commitments are thus essentially fixed. Therefore, although each individual technically has 24 hours in a day, different people face different discretionary time constraints depending on their life circumstances.

This study hypothesizes that time-poor individuals may not be able to prepare and eat healthy meals or to exercise. These hypotheses are tested by estimating a simultaneous model that jointly analyzes the relations between time poverty and fast food purchases, the number of eating and drinking occurrences, minutes spent engaging in sports and exercise, and engaging in active travel (walking or biking twenty minutes or more). Better understanding of Americans' eating and activity behaviors can provide insight into policies and programs that address obesity issues.

Theory

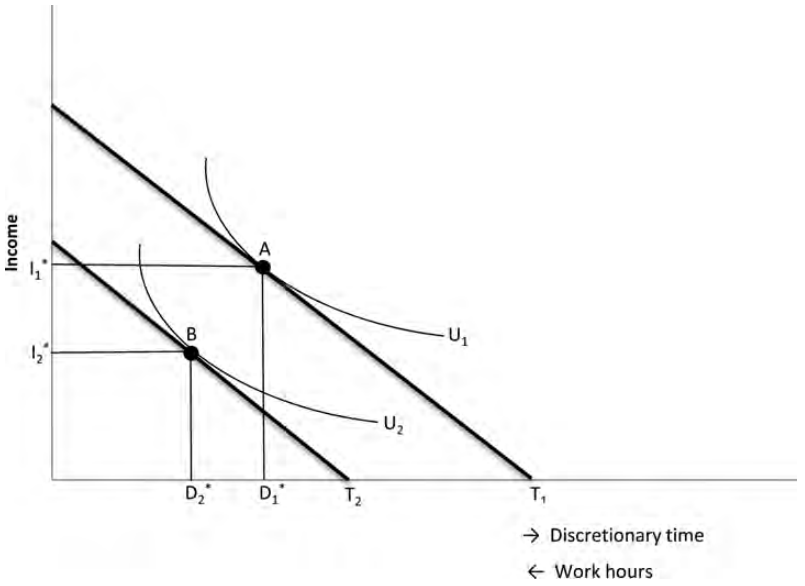
In the standard labor-leisure model, discretionary time, T, is divided into two categories, labor and leisure. Paid work would fall under the category of labor, while preparing and eating healthy meals and exercising would fall under the category of leisure. While predictions from the model based on T can be made, most analyses assume that T is fixed and is the same for all individuals. However, due to people's differing commitments, for example, due to a minimum amount of child care that must be performed, people do indeed have different levels of discretionary time. In figure 1, individual 1 has more discretionary time, T_1, than individual 2, T_2. Because the individuals' discretionary time is different, the maximum hours that they work and the maximum income from their work are different, even if their wage rates are the same. Consequently, individual 1, with greater discretionary time, will be able to attain a labor-leisure choice on a higher indifference curve with greater utility (U_1) than individual 2 (U_2). Labor-leisure choice A on U_1 allows for more hours worked and more income (I_1), but also more discretionary hours (D_1) than individual 2's choice B with less income (I_2) and less discretionary time (D_2).

Literature Review

The concept of time poverty is not new. Vickery (1977), Douthitt (2000), and Davis and You (2011) modified existing income poverty thresholds to account for time constraints. Gershuny (2011) developed the "triangle of daily activities," which includes leisure, unpaid work, and paid work to represent work-life balance when measuring national well-being. Other authors defined time poverty and calculated time poverty thresholds for various countries: Bardasi and Wodon (2006) for Guinea; Harvey and Mukhopadhyay (2007) for Canada; McGinnity and Russell (2007) for Ireland; Burchardt (2008) for the United Kingdom; Spinney and Millward

[1] *More detail regarding the classification of necessary, committed, and discretionary activities is provided in the appendix.*

Figure 1 Labor-Leisure Choices with Different Amounts of Discretionary Time



(2010) for Canada; and Kalenkoski, Hamrick, and Andrews (2011) for the United States. Zacharias (2011) compared alternative approaches to defining time and income poverty and discussed their potential role in anti-poverty policies.

Fewer studies, however, have investigated the associations of time poverty and individuals' behavior. Mothersbaugh, Hermann, and Warland (1993) examined the relationship between perceived time pressure and people's adherence to recommended dietary practices (RDPs), and found that perceptions of time pressure do indeed have adverse effects on individuals' eating habits and RDPs. Although he did not directly measure time poverty, Christian (2009) found that longer commutes were associated with less time spent in exercise and other health-related activities, and were also associated with substitution into lower-intensity exercise. In addition, he found that longer commutes increase the likelihood of non-grocery food purchases. Spinney and Millward examined the associations between time and income poverty and participation in moderate or higher intensity physical activities, and concluded that " . . . time poverty may be more important than income poverty as a barrier to regular physical activity," (Spinney and Millward 2010).

Eating patterns have been found to matter for health outcomes. By using the Seasonal Variation of Blood Cholesterol Study data, Ma et al. (2003) found that a greater number of eating episodes per day was associated with a lower risk of obesity. Using the American Time Use Survey (ATUS) Eating and Health (EH) Module data, Hamermesh (2010) found a similar result, that the frequency of eating meals (primary eating occurrences) and grazing (secondary eating occurrences) were associated with lower BMI and better self-reported health. Kolodinsky and Goldstein (2011) also used the ATUS and EH Module data to investigate the relationships between time use and food patterns and obesity, and found that

increases in time spent in meal preparation and cleanup are associated with decreases in BMI.

Eating food away from home (FAFH) also has been found to matter for health outcomes. Binkley, Eales, and Jekanowski used the 1994-96 Continuing Survey of Food Intake by Individuals (CSFII) and found a positive relationship between respondents' BMI and FAFH consumed in the previous 24 hours. They concluded that "FAFH, and particularly fast food consumption, are likely to be contributing factors to increased obesity," (Binkley, Eales, and Jekanowski 2000). Todd, Mancino, and Lin, using the 1994-96 CSFII and the 2003-04 National Health and Nutrition Examination Survey (NHANES) data, concluded that FAFH " . . . is a contributing factor to poor diet quality and that concern about FAFH's effect on obesity is warranted," (Todd, Mancino, and Lin 2010). These authors also found that one additional meal eaten away from home increases daily caloric intact by about 134 calories, and lowers diet quality by two points on the Healthy Eating Index.

Looking specifically at fast food, the literature is mixed on the effects of fast food on obesity. Binkley et al. (2000) and Jeffery et al. (2006) found that fast food consumption was positively associated with BMI. Mehta and Chang (2008) studied food environment and found that a higher ratio of fast food to full-service restaurants was associated with higher BMIs. Bowman and Vinyard (2004) found an association between fast food consumption and overweight status, but characterized that relationship as being weak. However, Cutler et al. (2003) found that Americans' increased caloric intake is from more snacks, whereas the increase in fast food consumption is a result of reduced home consumption. Thus, fast food calories are offsetting fewer calories eaten at home. Despite this mixed evidence, the Institute of Medicine of the National Academies report (2012) categorizes fast food restaurants as "unhealthy food venues" (p. 3).

Physical activity also affects health outcomes. Hemmingsson and Ekelund (2007) collected their own data measuring physical activity with accelerometry, and tested the generally-accepted inverse relationship between physical activity and BMI. They found that physical activity and BMI are only weakly associated for non-obese individuals, but are highly significantly associated for obese individuals. Stamatakis, Hirani, and Rennie (2009) investigated the relationships of physical activity types—from inactive to sufficiently active for obesity prevention—and sedentary behavior with BMI using the 2003 Scottish Health Survey. These authors concluded that physical activity and sedentary behavior are both strongly and independently related to obesity, for obesity defined as BMI $\geq$30 kg/m^2 and waist circumference (WC) $\geq$88 cm in women and $\geq$102 cm in men. Dunton et al. used the 2006 ATUS and EH Module data to examine the interaction between time spent in physical activity and in sedentary behavior on BMI. They concluded that "sedentary behaviors and physical activity interact with each other in relation to BMI in adults," (Dunton et al. 2009).

Long-run trends in obesity have also been studied (Cutler et al. 2003; Variyam 2005), and a variety of environmental factors have been identified as contributing to these long-run trends. Powell and Chaloupka (2009) point to the decline in food prices and the increase in the availability of fast

food and restaurant meals, and Chou et al. (2004) point to the increased price of cigarettes and the reduction in smoking. Another important contributor to the increase in Americans' body size has been the changing nature of work. Both technological advances and industrial restructuring in the United States have resulted in the decline in physical exertion required for performing paid work. Philipson and Posner stated this trend concisely by noting that in an agricultural or industrial society, "work is strenuous; in effect, the worker is *paid* to exercise," whereas in a post-industrial society, "people must *pay* for undertaking—rather than be paid to undertake—physical activity" (Philipson and Posner 2003). As a result, individuals then pay for exercise by budgeting their recreational time. "The full price of physical activity is the opportunity cost of allotted time—the value of the most preferable alternative given up by allotting time for a walk in the neighborhood or a run in the park" (Variyam 2005).

The contribution of the present study is to utilize the very detailed and comprehensive ATUS data to examine both sides of the energy-balance equation–both input and expenditure of energy. As such, it analyzes how time poverty is associated with fast food purchases, the number of eating and drinking occurrences, the number of minutes engaged in sports and other exercise, and time engaged in active travel.

Data

The Bureau of Labor Statistics' American Time Use Survey data were used for this study. One individual aged 15 or older from each sampled household was interviewed about his or her activities for the 24-hour period from 4 A.M. the day before the interview to 4 A.M. the day of the interview. Survey respondents were asked to identify their primary activity if they were engaged in more than one activity at a time. They were also asked to report where they were and who else was present for each activity. In addition to the time-diary data, demographic, labor force participation, and household information was collected from the respondents. This study used the Respondent, Activity, Activity Summary, and Methodology (Case History) files from the ATUS, as well as the EH Module Respondent, Activity, and Replicate Weights files. The analysis was limited to the years 2006-2008 because the EH files were available for this period only.[2] From 2006-08, the ATUS and EH Module resulted in 37,832 completed interviews of individuals aged 15 or over. The replicate weights from the EH Module produce nationally-representative estimates for an average day over this period. Excluding those with bad diaries,[3]

[2]*See U.S. DOL BLS (2010) for discussion of using the American Time Use Survey data, and Hamrick (2010) and Hamrick et al. (2011) for discussion of using the Eating & Health Module data.*

[3]*After each ATUS interview is completed, the Census interviewer answers two data quality questions: "Is there any reason the information from this interview should NOT be used?" and "Why do you think the data should not be used?" In 275 cases of the 37,832 completed interviews, the Census interviewer thought that the respondent's time diary was not of good quality, as indicated by the variable TUDQUAL2 from ATUS Case History data file. We defined a poor-quality time diary as one where TUDQUAL2 had a value of 1 (intentionally wrong), 2 (could not remember), 3 (deliberately long durations), or 4 (other reason).*

those under age 20, and those that are underweight,[4] the resulting sample size is 32,392.[5]

One potential drawback of the ATUS diary data is that information on only one time-diary day per person was collected. There may be concern that some activities, such as eating fast food or engaging in sports and exercise, are not daily activities and thus that a one-day diary such as the ATUS lacks intrapersonal variability. However, some activities, such as eating patterns, have a large degree of persistency, meaning that day-to-day variation is minimal; Wansink's (2007) *Mindless Eating* discusses the myriad external influences that result in eating habits. Exercise is also considered to be a habit, and researchers have studied what contributes to habitual exercise (Aarts et al. 1997; Finlay et al. 2002). Indeed, much of an individual's daily activities can be classified as habitual repetition (Neal et. al. 2006).

Nevertheless, food intake surveys are typically multiday surveys. For example, the NHANES includes two 1-day food recall interviews.[6] However, because the second-day diaries have a higher rate of nonresponse, and because respondents' consistent reports of less food consumption on the second day suggest under-reporting, some researchers elect to use only the first diary day (Gregory et al. 2012).

Indeed, existing research supports using a one-day diary to analyze individuals' activity patterns. Lambe et al. (2000) examined food consumption using 14-day diaries in five locations in the European Union. Among their findings was that the quality of the diaries declined over the 14 days, with the best information and most variation obtained in the first three days. However, they found that mean intakes of a given food item were not affected by survey duration. More recently, Raux et al. (2011) studied seven-day travel diaries for individuals in Ghent, Belgium, and concluded that while there is a large amount of interpersonal variability (differences across individuals in their travel patterns), there is small intrapersonal variability (variation across an individual's seven days of time diaries). Likewise, Schmidt (2011) studied seven-day diaries of Germans' payments (consumer expenditures), both cash and noncash, with a focus on cash payments, and found that survey fatigue is apparent and that more cash payments were recorded on day one. However, the distribution of payments during diary days 2–7 is similar, leading Schmidt to conclude "that additional diary days only increase the sample size, rather than provide additional information" Schmidt (2011).

[4]*We exclude those under 20 years old because the Centers for Disease Control adult BMI interpretation is for persons aged 20 and over. Body Mass Index is calculated as: weight (lb) / [height (in)]^2 × 703. Adult BMI groups are underweight (BMI <18.5), normal weight (18.5 ≤ BMI < 25), overweight (25 ≤ BMI < 30), and obese (30 ≤BMI). See CDC for more information on adult BMI: http://www.cdc.gov/healthyweight/assessing/bmi/index.html. We exclude those who are underweight because of the small number of respondents. Those who have a BMI less than 18.5 comprise 1.4% of respondents aged 20 and over with a BMI value. It is the authors' experience that because of the small cell size, this group's characteristics and patterns can be dominated by a small number of respondents who engage in activities for a long duration. Having a small number of respondents dominate an estimate, in some cases as few as 2 respondents, is an indicator that the cell size is not large enough for analysis.*

[5]*Creation of the analysis data set was done using SAS 9.2 and STATA 12 and estimation was performed using STATA 12.*

[6]*For more information on NHANES, see http://www.cdc.gov/nchs/nhanes.htm.*

Variables

Two measures of eating patterns are available using the ATUS data, an indicator variable for whether or not fast food was purchased on the diary day, and the number of eating and drinking occurrences on the diary day (both primary and secondary).[7] Two measures of physical activity can be created using the ATUS data, minutes spent on sports and exercise (ATUS activities 1301xx) on the diary day, and an indicator variable for whether or not the respondent engaged in active travel (walked or biked twenty minutes or more on the diary day (ATUS activities 18xxxx and TEWHERE = 14 or TEWHERE = 17). Twenty minutes of daily exercise is a federal guideline for weight management.[8]

Eating and drinking is a daily activity for almost everyone, and food consumption away from home takes place several times a week, on average.[9] Active travel is likely to be a daily activity for those who engage in it, especially if they walk or cycle for all or part of a commute to work. Therefore, the only measure that is likely to be underestimated by using one-day diary data is sports and exercise, which is typically not a daily activity, although it can be considered a habitual activity.

The key explanatory variable in this analysis is an indicator for whether or not individuals are time-poor. This indicator takes a value of one if total daily discretionary time is less than 289.8 minutes (4.83 hours), and a value of zero otherwise. The cutoff of 60% of the median discretionary time as calculated by Kalenkoski, Hamrick, and Andrews (2011) was used.[10] Discretionary time is defined as total daily minutes (i.e., 1440) minus time spent on personal care, market work, household work, child care, and adult care.

Other explanatory variables available in the ATUS are an indicator variable for whether or not the diary day that was a holiday or weekend day; an indicator variable for whether or not the respondent is female; age measured in number of years; an indicator variable for whether or not the respondent is married; the number of children in the household; an

[7] *We defined a fast-food purchase as one where travel (180782) was followed by food purchase (070103) at a restaurant (TEWHERE = 4). We included both respondents who ate the food at the restaurant and those who carried out the food. By including only the 070103 cases with TEWHERE = 4, we excluded purchasing food at TEWHERE = 7 (other store, mall) and TEWHERE = 11 (other place). The U.S. Census Bureau has identified that secondary eating at these "other place" locations is usually at an entertainment venue such as a stadium or movie theater (e-mail correspondence from BLS to Karen S. Hamrick dated February 29, 2008). By selecting those who pay first, that is, those who purchase at a counter-service restaurant, we excluded those who were at sit-down restaurants and reported talking with waiters and waitresses or interacting with restaurant cashiers at the end of the meal, which are also coded as 070103. Including these individuals did not qualitatively change the results. Also note that selecting those cases where the individual paid first will include both* fast food *or* quick service *restaurants (e.g., McDonald's, Kentucky Fried Chicken, Dunkin' Donuts) and* fast casual *restaurants (e.g., Panera Bread, Cosi, Corner Bakery), which tend to have fresher, lighter fare than fast food restaurants.*

[8] *http://www.cnpp.usda.gov/Publications/DietaryGuidelines/2010/PolicyDoc/Chapter2.pdf. Page 17.*

[9] *The National Restaurant Association's 2000 survey found that Americans aged 8 and older consume an average of 4.2 commercially prepared meals per week (National Restaurant Association 2000). Men are more likely to consume commercially prepared meals. About 22% of men's meals, and about 18% of women's meals are commercially prepared. Because restaurant sales have increased in real dollars by about two-thirds from 2000–2012 (projected), the frequency of consumption of commercially-prepared meals is likely to have increased since the 2000 survey (National Restaurant Association 2012).*

[10] *Kalenkoski, Hamrick, and Andrews (2011) performed an extensive sensitivity analysis using alternative definitions of time poverty. The results of those sensitivity analyses are discussed in that paper.*

indicator variable for whether income is greater than 185% of the poverty threshold; [11] an indicator variable for whether income is missing; and an indicator variable for whether or not the respondent has at least a bachelor's degree.

Model

Three probit models and two continuous regressions are jointly estimated:

$$F^* = B_{F0} + B_{F1}TP + B_{F2}X + E_F$$
$$F = 1 \, if \, F^* > 0$$
$$F = 0 \, if \, F^* \leq 0$$
$$A^* = B_{A0} + B_{A1}TP + B_{A2}X + E_A$$
$$A = 1 \, if \, A^* > 0$$
$$A = 0 \, if \, A^* \leq 0$$
$$TP^* = B_{T0} + B_{T1}X + B_{T2}Y + E_T$$
$$TP = 1 \, if \, TP^* > 0$$
$$TP = 0 \, if \, TP^* < 0$$
$$N = B_{N0} + B_{N1}TP + B_{N2}X + E_N$$
$$S = B_{S0} + B_{S1}TP + B_{S2}X + E_S,$$

where F^* is a latent variable representing a fast food purchase; F is an indicator variable equal to 1 if fast food was purchased and 0 otherwise; A^* is a latent variable representing active travel; A is an indicator variable equal to 1 if the respondent engaged in active travel on the diary day and 0 otherwise; TP^* is an indicator variable representing non-discretionary time; TP is an indicator variable equal to 1 if the respondent was time-poor and 0 otherwise; N is the number of eating occurrences on the diary day; and S is the number of minutes spent on sports and exercise on the diary day.

Note that TP is the key explanatory variable in each of the time-use equations. Because it is a potentially endogenous regressor, it is modeled jointly with these uses of time. The variable X is a vector of demographic and other characteristics of the respondent and his/her household, while Y is a vector of additional variables in the time poverty probit that may help identify time poverty in the other equations. The B's are estimated coefficients on the explanatory variables, and the E's are the error terms. Subscripts for the individual are suppressed for clarity. Because all of the activities we analyze were engaged in by the same individual, and because they were all subject to the same time constraint, we allow the error terms to be correlated across models.

[11] *The EH Module asks respondents whether their household income is greater or less than the dollar amount of 185% of the poverty threshold, which corresponds with the income eligibility thresholds for reduced-price school meals and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). We use the 185% poverty threshold level to define individuals in low-income households.*

Results

Table 1 presents weighted descriptive statistics for the full sample (those aged 20 and over who participated in the EH module and also provided good time diaries), and for the time-poor and not time-poor subsamples. These descriptive statistics reflect an average day for the years 2006–08. There are 6,571 persons (20%) in the sample categorized as time-poor, and 25,821 persons (80%) are categorized as not time-poor. Eight percent of Americans aged 20 and older purchased fast food on an average day. Seven percent of those who were time-poor purchased fast food, while 9% of those who were not time-poor purchased fast food. The average number of eating and drinking occurrences[12] per day was just under three, with time-poor individuals having fewer eating and drinking occurrences (2.7) than not time-poor individuals (2.9). Nineteen minutes was the daily average number of minutes spent on sports and exercise, but there was a dramatic difference between the average number of minutes spent on these activities by those who were time-poor (6 minutes) and those who were not time-poor (22 minutes). Five percent of respondents were engaged in active travel; 4% of the time-poor and just over 5% of the not time-poor.

Men were more likely to be time-poor, perhaps because of their greater labor force participation. Younger individuals were more likely to be time-poor than older individuals, while married people and people living with more children in their households were also more likely to be time-poor. Higher-income individuals were more likely to be time-poor, as were more highly educated individuals.

Table 2 presents results from a maximum likelihood model that jointly estimates the fast food and active travel probits and the continuous regressions representing the number of eating and drinking occurrences and the number of minutes spent on sports and exercise. This model accounts for correlations in the errors of the activity equations but treats time poverty as exogenous (i.e., excludes the time poverty equation from the model).

Time-poor individuals have different eating patterns than not-time-poor individuals. Being time-poor is associated with a reduction in the likelihood of a fast food purchase on an average day by 3%, perhaps due to the time needed to travel to a fast food establishment and to wait in line; that is, fast food may not in fact be fast to those with limited time. If fast food is indeed unhealthy food, this is good news for time-poor individuals. Time poverty is also associated with a reduction in the number of eating and drinking occurrences on an average day by 0.27. This is a substantial effect, given that the average number of eating and drinking occurrences for the full sample is 2.9. According to Ma et al. (2003) and Hamermesh (2010), this means a greater risk of obesity for time-poor individuals. Time-poor individuals also have different activity patterns than do not-time-poor individuals. Time-poor individuals spend almost 18 minutes less on sports and exercise on a given day than do not-time-poor individuals, a large effect given that the average time spent by all individuals is almost 19 minutes. Similarly, time-poor individuals are 1% less likely to engage in active travel than not-time-poor individuals. Thus,

[12]*Eating and drinking occurrences include both* primary eating and drinking *(eating and drinking beverages as a main activity) and* secondary eating *and* secondary drinking *(eating and/or drinking beverages as a secondary activity while doing something else as the primary activity).*

Table 1 Weighted Means and Standard Errors, Means for an Average Day, 2006–08, age 20+

	All N = 32,392	Time-Poor N = 6,571	Not Time-Poor N = 25,821
Purchased fast food, 1 = YES and 0 = NO	0.084 (0.002)	0.066 (0.004)*,#	0.089 (0.002)#
Number of eating and drinking occurrences, primary and secondary	2.898 (0.014)	2.747 (0.025)*,#	2.945 (0.016)#
Minutes spent on sports and exercise	18.518 (0.434)	6.017 (0.343)*,#	22.365 (0.553)*,#
Walked or biked twenty minutes or more, 1 = YES and 0 = NO	0.050 (0.002)	0.044 (0.003)#	0.052 (0.002)
Time-Poor, 1 = YES and 0 = NO	0.235 (0.003)	-	-
Diary day is weekend or holiday, 1 = YES and 1 = NO	0.300 (0.001)	0.133 (0.004)*,#	0.352 (0.002)*,#
Female, 1 = female and 0 = male	0.496 (0.001)	0.471 (0.007)*,#	0.504 (0.002)*
Age (years)	47.097 (0.038)	41.364 (0.181)*,#	48.861 (0.082)*,#
Married, 1= YES and 0 = NO	0.594 (0.003)	0.645 (0.007)*,#	0.579 (0.004)*,#
Number of household children	0.705 (0.005)	1.013 (0.019)*,#	0.611 (0.006)*,#
Income > 185% poverty threshold, 1 = YES and 0 = NO	0.691 (0.003)	0.730 (0.007)*,#	0.679 (0.004)#
Income missing, 1 = YES and 0 = NO	0.027 (0.001)	0.013 (0.002)*,#	0.031 (0.002)#
Bachelor's degree or higher, 1 = YES and 0 = NO	0.290 (0.003)	0.330 (0.007)*,#	0.277 (0.004)*,#

Notes: Standard errors are in parentheses. Eating & Health Module replicate weights were used to calculate the standard errors.
** indicates estimate is significantly different from the total population estimate at the 90% confidence level.*
 # indicates that Time-Poor and Not Time-Poor estimates are significantly different from each other at the 90% confidence level.
Source: American Time Use Survey and Eating & Health Module data.

Table 2 Time Poverty and Daily Eating and Activity Patterns: Time Poverty Treated as Exogenous, Estimated Marginal Effects, and Standard Errors

	Fast Food	Number of Eating and Drinking Occurrences	Minutes Spent in Sports and Exercise	Active Travel
Time-poor	-0.034***	-0.273***	-17.647***	-0.012***
	(0.004)	(0.031)	(0.778)	(0.003)
Female	0.015***	0.140***	-10.523***	-0.007**
	(0.004)	(0.027)	(0.835)	(0.003)
Age	-0.001***	0.002**	-0.202***	-0.001***
	(0.000)	(0.001)	(0.030)	(0.000)
Married	-0.006	0.128***	-1.141	-0.036***
	(0.005)	(0.031)	(0.924)	(0.004)
Number of children	0.005**	0.010	-0.502	0.001
	(0.002)	(0.012)	(0.412)	(0.002)
Income > 185% of income poverty threshold	0.042***	0.283***	8.259***	-0.025***
	(0.004)	(0.031)	(1.006)	(0.004)
Income missing	-0.022*	0.197	7.851**	-0.011
	(0.012)	(0.173)	(3.079)	(0.009)
Bachelor's degree	0.003	0.321***	4.454***	0.026***
	(0.005)	(0.026)	(1.022)	(0.004)
Weekend or holiday	-0.011***	-0.248***	3.669***	-0.008***
	(0.004)	(0.029)	(1.008)	(0.003)
Error Correlations				
RhoFN–between fast food purchase and the number of eating and drinking occurrences				0.045***
				(0.011)
RhoFS–between fast food purchase and minutes spent in sports and exercise				-0.022*
				(0.013)
RhoFA–between fast food purchase and engaging in active travel				0.033
				(0.031)
RhoNS–between the number of eating and drinking occurrences and minutes spent in sports and exercise				0.015
				(0.010)
RhoNA–between the number of eating and drinking occurrences and engaging in active travel				0.025*
				(0.011)
RhoSA–between minutes spent in sports and exercise and engaging inactive travel				0.054***
				(0.014)
Number of observations				32,392
Prob > Chi2				0.0000

Notes: An intercept is included in all equations. Standard errors are in parentheses and were calculated using Eating and Health Module replicate weights.
Marginal effects for the fast food and active travel probit equations are calculated at the mean. For discrete explanatory variables, marginal effects measure the effects of discrete changes in the dummy variables from 0 to 1.
**** indicates statistical significance at the 1% level, ** indicates statistical significance at the 5% level, and * indicates statistical significance at the 10% level.*

time-poor individuals are at risk of obesity given that they expend fewer calories through physical activity than do not-time-poor individuals.

RhoFN is the estimated error correlation between a fast food purchase and the number of eating and drinking occurrences on an average day. RhoFN is positive and statistically significant, suggesting that there is an

Table 3 Time Poverty and Daily Eating and Activity Patterns: Time Poverty Treated as Endogenous Estimated Coefficients, Standard Errors, and Calculated Marginal Effects

	Fast Food	Number of Eating and Drinking Occurrences	Minutes Spent in Sports and Exercise	Active Travel	Time-Poor
Time-poor	-0.320***	2.224	-16.172	-0.179**	
	(0.066)	(1.516)	(49.114)	(0.090)	
	[-0.041]			[-0.015]	
Female	0.103***	0.174***	-10.503***	-0.074**	-0.046
	(0.026)	(0.036)	(1.084)	(0.033)	(0.098)
	[0.015]			[-0.007]	[-0.014]
Age	-0.010***	0.012*	-0.196	-0.009***	-0.013***
	(0.001)	(0.006)	(0.199)	(0.001)	(0.004)
	[-0.001]			[-0.001]	[-0.004]
Married	-0.036	0.025	-1.202	-0.360***	0.129***
	(0.032)	(0.073)	(2.254)	(0.036)	(0.033)
	[-0.005]			[-0.035]	[0.040]
Number of children	0.035***	-0.079	-0.555	0.013	0.093***
	(0.014)	(0.055)	(1.823)	(0.018)	(0.022)
	[0.005]			[0.001]	[0.029]
Income > 185% of income poverty threshold	0.318***	0.220***	8.221***	-0.253***	0.089
	(0.033)	(0.048)	(1.600)	(0.040)	(0.070)
	[0.043]			[-0.025]	[0.027]
Income missing	-0.171*	0.316*	7.921*	-0.131	-0.295***
	(0.103)	(0.185)	(4.263)	(0.115)	(0.113)
	[-0.022]			[-0.011]	[-0.082]
Bachelor's degree	0.020	0.253***	4.414**	0.257***	0.091***
	(0.035)	(0.056)	(1.770)	(0.038)	(0.035)
	[0.003]			[0.026]	[0.029]
Weekend or holiday	-0.087***	0.220	3.945	-0.095***	-0.581***
	(0.030)	(0.283)	(9.218)	(0.037)	(0.094)
	[-0.012]			[-0.008]	[-0.165]

Error Correlations

RhoFN – between fast food purchase and the number of eating and drinking occurrences	0.027
	(0.019)
RhoFS – between fast food purchase and minutes spent in sports and exercise	-0.023*
	(0.014)
RhoFA – between fast food purchase and engaging in active travel	0.032
	(0.030)
RhoFT – between fast food purchase and time poverty	0.036
	(0.035)
RhoNS – between the number of eating and drinking occurrences and minutes spent in sports and exercise	0.018
	(0.018)
RhoNA – between the number of eating and drinking occurrences and engaging in active travel	0.011
	(0.019)
RhoNT – between the number of eating and drinking occurrences and time poverty	-1.058
	(0.647)
RhoSA – between the minutes spent in sports and exercise and engaging in active travel	0.054***
	(0.014)
RhoST – between the minutes spent in sports and exercise and time poverty	-0.016
	(1.167)

Continued

Table 3 *Continued*

Error Correlations	
RhoAT–between engaging in active travel and time poverty	0.026
	(0.055)
Number of observations	32,392
Prob > Chi2	0.0000

Notes: An intercept is also included in all equations.
Eating and Health Module replicate weights were used to calculate standard errors.
Marginal effects for the fast food, active travel, and time poverty probit equations are calculated at the mean. For discrete explanatory variables, marginal effects measure the effects of discrete changes in the dummy variables from 0 to 1.
**** indicates statistical significance at the 1% level, ** indicates statistical significance at the 5% level, and * indicates statistical significance at the 10% level.*

unobserved factor, perhaps a time constraint, that limits long periods for meals and thus leads to a greater probability of a fast food purchase and more short eating occurrences throughout the day. RhoFS is the estimated error correlation between a fast food purchase and the number of minutes spent on sports and exercise; it is negative and statistically significant, suggesting that an unobserved factor, such as a preference for a healthy lifestyle, leads to a lower likelihood of a fast food purchase and more minutes spent on sports and exercise. RhoNA, the estimated error correlation between the number of eating and drinking occurrences and active travel, is positive and statistically significant, perhaps also reflecting an unobserved preference for healthy living. Finally, RhoSA is the estimated error correlation between the number of minutes spent on sports and exercise, and the probability of active travel; it is positive and statistically significant, again suggesting that a person's desire to have a healthy lifestyle leads to more time spent on sports and exercise and a greater likelihood of walking or biking more than 20 minutes on an average day.

Table 3 presents results that control for the possibility that time poverty is endogenous[13] (i.e., a time poverty probit is added to the previous simultaneous equations model). Time poverty may be endogenous because it depends on time spent in other activities such as personal care, market work, and household work. Although we have argued that these daily activities are largely fixed given prior commitments to work and family, there may be discretionary time spent on these activities that was jointly chosen with time spent eating and engaging in physical activity.

Once the potential endogeneity of time poverty is controlled for, time poverty is no longer a statistically significant determinant of the number of eating and drinking occurrences, or the number of minutes spent on sports and exercise. However, time-poor individuals are still significantly less likely to purchase fast food, with time-poor individuals 4% less likely to make a fast food purchase than not-time-poor individuals. They are also 2% less likely to engage in active travel. These effects are only slightly larger in magnitude than those from the model that did not account for

[13]*The results in tables 2 and 3 are presented differently. In table 2, marginal effects and standard errors of the marginal effects are presented for the probit models. However, the complexity of the model in table 3 renders calculation of the standard errors of the marginal effects of the probit models inappropriate. Indeed, STATA SE 12 refuses to compute them. Thus, in table 3, for the probit outcomes, coefficient estimates, standard errors of the coefficient estimates, and marginal effects are presented.*

endogeneity. Most of the other explanatory variables retain similar effects across models. Thus, controlling for endogeneity appears only to eliminate the associations of time poverty with the number of eating and drinking occurrences and minutes spent on sports and exercise.

It should be noted that no "instruments" are included in the time poverty equation to identify time poverty in the other equations. Metro status, the state-level monthly unemployment rate, and the state-level cost of child care as a percentage of income were all tried as possible instruments, as each could potentially affect an individual's discretionary time. However, none of these was a significant correlate of time poverty. It is likely that this lack of significance is due to the limited geographic information available in the ATUS, which provides information on the state in which a respondent lives, but these variables are likely more relevant at the county or local level. Nevertheless, our model is identified by nonlinearities (Roodman 2011).

Conclusion

Understanding the complexities of Americans' eating and activity behaviors is important for addressing America's high obesity rate. These findings on the relationships between time poverty and fast food purchases, the number of eating and drinking occurrences, time spent engaged in sports and exercise, and active travel shed light on this issue. To their benefit, time-poor individuals are less likely to purchase fast food, which is considered by some to be generally unhealthy. This finding presents the possibility that time-poor individuals are purchasing prepared food from grocery stores or other venues. Research is needed to better understand convenience foods and their sources. To their detriment, time-poor individuals are also less likely to engage in active travel. One possible policy implication of this finding is that policy-makers could consider the development of sidewalks and bike paths to encourage individuals to walk or cycle more frequently. Employers could also implement programs to encourage active travel to work, such as taking steps to earn the designation of "Bicycle Friendly Business."

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Appendix—Necessary, Committed, and Discretionary Activities by Major Activity Group

	ATUS Major Activity Code
Necessary activities	
Personal care (includes sleeping and grooming)	01
Committed activities	
Household activities (includes housework, food & drink prep.)	02
Caring for and helping household members, both children and adults	03
Work and work-related activities	05
Discretionary activities	
Caring for and helping non-household members	04
Education	06
Consumer purchases	07
Professional and personal care services (includes banking, paying for daycare, doctor's appointment, getting a haircut)	08
Household services (includes dropping off/picking up clothes from dry cleaner, hiring a plumber for home repair, waiting while car is repaired)	09
Government services and civic obligations (includes using social services, getting car inspected, serving on jury duty, voting)	10
Eating and drinking	11
Socializing, relaxing, and leisure (includes entertaining family and friends, watching television, computer use for leisure, attending performing arts event, gambling)	12
Sports, exercise, and recreation (includes participating in sports and attending a sporting event)	13
Religious and spiritual activities	14
Volunteer activities	15
Telephone calls	16

Note: Related waiting and travel times are included in each use of time. Source: Kalenkoski, Hamrick, and Andrews (2011).