Time Use and Food Consumption

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I. Introduction

People are getting fat. The rise in obesity rate has been particularly sharp in the United States since the middle of the 1970s, but has by now extended into many other areas of the world (World Health Organization). Several types of technological change have been singled out as potential explanations for why people have been gaining so much weight. Increased productivity in agriculture has lowered the relative price of food (Lakdwalla and Philipson, 2005) while innovations in food processing have reduced the time cost of preparing food (Cutler, Glaeser and Shapiro, 2003). Technological change has also affected how people spend their time, in a way that may systematically have reduced calories expended. First, physically less demanding jobs in the service sector have replaced physically more demanding jobs in agriculture and manufacturing. Second, the allocation of time across different activities has changed dramatically over the last few decades: people are spending less time working (decline in labor market work for men, decline in home production work for women) and more time in mainly sedentary forms of leisure, such as watching television (Aguiar and Hurst, 2007). Everything else equal, substituting an hour of work on the factory floor, or an hour of work cleaning the house, with an hour watching television lowers calorie expenditure and increases weight.

While people researching obesity have mainly focused on the relationship between how people spend their time and how many calories they expend, we argue in this piece that there might also be an interesting relationship between how people spend their time and how many calories they consume. Motivating this question is an (at first glance) rather counter-intuitive finding from the time use surveys: the fact that people are spending less and less time eating.[1] Of course, while this could be reconciled with weight gain if people now consume more calories per minute eating, recent evidence from a new Eating and Health Module of the American Time Use Survey (ATUS) reveals that this may not be the only explanation. Rather, it appears that a lot of time spent eating and drinking occurs as "secondary" activity (e.g. eating while watching television, or eating while working). For example, while on an average day in

[1] This is particularly true for the less educated (see Table VII in Aguiar and Hurst, 2007).

2006, Americans age 15 and older spent only 67 minutes eating and drinking as a "primary" activity, the total time spent eating or drinking, both as primary and secondary activities, is closer to two hours.[2] Models from psychology suggest that such eating patterns may matter for how much people eat. When eating in high cognitive load situations (e.g. the snacking that occurs when preparing a research report, or when engrossed in a really good film or one's favorite reality show), people may be more distracted and pay less attention to how much they eat. Wansink (2006) discusses various controlled experiments suggesting that such "mindless eating" might be especially common when eating stops being the primary activity.[3]

Using an original dataset that collects detailed information on what people do and what they eat over the course of the day, we show that secondary eating and drinking is not only relevant in terms of time spent, but also in terms of calories consumed. On an average day, half of all daily calories are consumed while also engaged in another task. We also quantify how many calories are consumed across various activities. We then offer two pieces of evidence suggesting that what people do (or not do) when they eat matters for how much they eat. First, we show that, on higher-calories days, a higher share of calories are consumed while doing something else than eating. Second, we offer some preliminary evidence that secondary eating might indeed be more mindless than primary eating.

II. Data

Survey Instrument

We use data from a new survey we designed in collaboration with the Economic Research Service (ERS) of the United States Department of Agriculture (USDA). The survey consisted in two interviews conducted over phone. The first (recruiting) interview, which lasted about 15 minutes, mainly focused on

[2] See http://www.ers.usda.gov/Data/ATUS/Current.htm.
[3] See also Shiv and Fedorikhin (1999) for experimental evidence on the relationship between cognitive load and the consumption of calorie-dense food (chocolate cake in this case).

collecting background socio-demographic information.[4] At the end of this first interview, individuals were asked whether they would be interested in participating in a second, longer (an hour to an hour and a half) interview about a week or so later. Individuals were informed they would receive a $50 check in exchange for participating in the second interview.

The second interview consisted in 3 main parts. The first part was a 24-hour recall time diary that was inspired by Khaneman and Kruger (2006)'s Day Reconstruction Method (DRM). Specifically, individuals were asked about individuals were asked to report how they spent their time yesterday (from midnight to midnight), as well as how they felt while engaged in each of the activities they performed yesterday.[5] Following Khaneman and Krueger, survey respondents were asked to "think of your day as a continuous series of scenes or episodes in a film. The episodes people identify usually last between 15 minutes and 2 hours. The end of an episode might be going to a different location, ending one activity and starting another, or a change in the people you are with." People's responses regarding which activities they were engaged in at a given point in the day were recorded verbatim, and then categorized using the ATUS code. If an individual reported doing multiple things at the same time (for example, watching television and eating or watching television and folding laundry), all these activities were recorded (and not just the primary activity). Also, we coded both the time at which a given activity started and the time at which it ended.[6]

Part two of the second interview consisted in a 24-hour dietary recall. Specifically, respondents were asked about everything they ate and drank yesterday, and when each food or drink was consumed. To assure the best quality of the dietary intake data, we use the USDA's Automated Multiple Pass Method

[4] We also collected at this stage subjective measures of well-being (such as overall life satisfaction) and self-control.
[5] Survey respondents were given a list of adjectives describing various positive and negative moods and asked, for each of these moods, whether it described how you felt while engaged in the activity. The adjectives were: frustrated or annoyed, happy, depressed or blue, warm or friendly, angry or hostile, worried, enjoying oneself, criticized or put down, tired, stressed, in control. For the purpose of this paper, though, we do not make use of the mood information that was collected at this stage of the survey.
[6] Respondents were also asked for each activity, to indicate where they were when the activity took place and who they were with, and whether food was easily available from that location.

(AMPM) for collecting food intakes; the food intake data were then sent through the Post Interview Processing System (PIPS) and coded using the SurveyNet system (version 3.14) and version 2.0 of the Food and Nutrient Database for Dietary Studies (FNDDS), supplied by the USDA Agriculture Research Service (ARS). While we have collected very rich data on the type of foods people eat, we only focus for this paper on one summary nutritional variable: energy (calories).[7]

Given the structure of both the time use survey and dietary recall, we can construct a unique database that maps each activity from the time use survey into the food or drinks that were consumed while engaged in this activity.

In the final part of the second interview, respondents were asked about their height and weight, used to compute BMI. They were also asked several questions aimed at describing their relationship with food (dieting behavior, guilt about overeating, thinking about food, optimal weight, whether they thought they ate too much or too little yesterday, etc…) which we plan to incorporate into future analysis.

Sample

Individuals were recruited to participate in the survey using a random-digit dialing (RDD) method. Only women over 18 years of age were invited to participate. In total, 593 women completed the recruiting interview, which corresponded to about a 25 percent response rate. Of these 593 people, 475 agreed to participate in the second interview. In the end, the main interview was completed with 85% of the respondents who agreed to be called back for a second interview. This translates into in a final sample of 400 women, and an overall response rate of 17 percent.

Maybe not surprisingly given the method of recruitment and the length of the second interview, the sample of respondents is disproportionately old and out of the workforce. The average woman in the sample is 51 years old (minimum=18; maximum=93; standard deviation 16). Twenty percent of the

[7] We have replicated the analysis below using total fat or total sugar instead of calories and found very similar patterns.

respondents are retired, and only 2 percent are students; 54 percent are working for pay. Average household income is $55,000. Sixty-four percent are currently married and the average household size (including the respondent herself) is 2.5. The average BMI is 27.7. Sixty percent of the respondents are overweight (BMI>25) and 30 percent are obese (BMI>30); less than 10 percent of the respondents have a BMI of 20 or less.

III. Analysis

Using the ATUS code, we categorize what people do over the course the day into the following categories: sleep, personal care, home production, caring for and helping others (including child care), work, education, shopping, using services (including professional services, personal care services and household services), participating in voluntary or civic or religious activities, socializing, relaxation and leisure (excluding watching TV and attending art and sporting events), watching TV, attending art and sporting events, participating in sports or exercise, being on the phone, travelling, and of course eating and drinking. Given our interest in better understanding what other activities people might be engaged in when they eat, we code as "eating and drinking" those times when a given respondent is *only* reporting to be eating and/or drinking. So, for example, if someone reports "snacking when watching TV," we code this activity as "watching TV." There are many instances where the time use data indicates that solely non-eating activities were performed during a given time period and yet, according to the dietary recall, some eating did occur during this time period. In those instances, we assume that the dietary recall data is correct and that the respondent simply omitted to indicate that eating also occurred over that time period. To a certain degree, those instances might be among the most interesting for us in that they might map best into those times when the eating was so "mindless" that the respondents did not even consider it as a separate activity.

Columns 1 to 3 of Table 1 summarize how the average respondent in our sample spent her recall day. Column 1 pools all days, while columns 2 and 3 focus on weekdays and weekend days respectively.[8] If a respondent did not engage in a given activity over the course of the day, we assign 0 minutes to that activity for that respondent. Across all days, the largest block of time is spent sleeping (nearly 500 minutes). In this sample, home production accounts for 158 minutes and work 147 minutes. About one hour and twenty minutes is spent travelling over the course of the day. Respondents socialize an average of 50 minutes per day. Relaxation and leisure time is dominated by watching TV. In fact, the average respondent spends more time watching TV (167 minutes) than engaging in another activity on our list, besides sleeping. On average, people report spending a little less than an hour (57 minutes) eating or drinking in isolation of any other activity. Not surprisingly, more time is spent working during weekdays (177 minutes; 404 minutes conditional on doing any work that day) than during weekend days. The extra time spent working is mainly taken out of sleep time, home production time, socializing, and watching TV (180 minutes during weekend days vs. 163 minutes during weekdays); people also spent less time "only eating" during week days than weekend days (53 minutes vs. 69 minutes).

Columns 3 and 6 of Table 1 describe how the calories consumed by the average respondent over the course of the day are distributed across the various activities. Average daily calories in our sample is 2050, with a minimum just below 400 and a maximum of about 7750 (standard deviation=890). Again, we show activity means both pooling all days (column 4) and separating week days and weekend days (columns 5 and 6 respectively). If a respondent did not engage in a given activity over the course of the day, we assign 0 calories to that activity for that respondent.

About 920 calories, or 46 percent of total daily calories are consumed while "only eating." The remaining calories intakes are spread across various activities. About 220 calories, or 11 percent of the daily total, are consumed while watching TV. About half of the episodes of TV watching are associated with some caloric intake; conditional on some calories being consumed while watching TV, an average 450 calories are consumed in front of the television. Individuals also "snack" a lot while engaged in home production

[8] Ninety-nine of the 400 recall days were week-end days (81 Sundays and 18 Saturdays).

(195 calories) and while travelling (127 calories). The subsequent largest blocks of caloric intakes take place while working (112 calories) and while socializing (112 calories). During week-end days, people consume a larger share of their caloric intake while "only eating" (1115 calories, or 52 percent of the daily total). Over the week-end, more calories are consumed when socializing (about 200 calories) than when watching TV (despite the longer time spent in front of the TV over the week-end). Calories consumed while doing chores or travelling are pretty much the same between week days and week-end days.

While these means are interesting because of the rich picture they paint of how people eat, they may be of little relevance when it comes to explaining *how much* people eat. It is possible that the allocation of calories across activities is neutral when it comes to total caloric intake over the course of the day. A "normal" sit-down meal consisting of a sandwich and a soda may just be replaced by eating a sandwich while preparing for a meeting with customers and drinking a soda while doing chores around the house. In contrast, under the view that more "mindless" eating occurs while eating is a secondary activity, one might expect that share of calories consumed outside of "eating only" times to be higher on higher-calories days. We show this to be true in the regressions presented in Table 2. The unit of observation in Table 2 is the survey respondent and the dependent variable is the fraction of total daily calories consumed while only eating and/or drinking. All regressions include the logarithm of the respondent's age, a dummy for working status, the logarithm of household size, and dummies for day of the week.[9] The dependent variable in all of regressions is the fraction of total daily calories consumed while only eating and drinking.[10] Column 1 shows that there is a negative relationship between the fraction of total calories consumed while only eating and/or drinking and the logarithm of total daily calories; the relationship is however not statistically significant. A much clearer pattern emerges when we single-out high-calories days. Column 2 shows that on days where total calories are above 2500 (26 percent of the observations),

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[10] Sample size is 397 because of missing age information for 3 respondents.

the share of calories consumed while also engaged in other activities is 8 percent larger. On days where the total calories intake is above 3000 (11.5 percent of the observations), the share consumed while also engaged in other activities is nearly 13 percent larger (column 3).

We also investigated whether there is a relationship between fraction of total daily calories consumed while only eating and drinking and individuals' BMI. While we find that overweight people consume more of their daily calories while engaged in other activities, the relationship is both economically weak (only a 2 percentage points difference) and statistically insignificant.[11] There is however some suggestive evidence that higher-calories days involve an especially high share of secondary eating for overweight people (columns 4 and 5). On days where more than 3000 calories are consumed, 15 percent more of these calories come from secondary eating for overweight people, compared to only 10 percent more for people that are not overweight.

We also studied which activities contribute for a larger share of total daily calories on high-calories days (more than 3000 calories). We highlight some our main findings. Among people that are overweight, there is a sharp increase in the share of calories consumed while doing chores (15 percent vs. 8 percent); the share of calories consume while socializing also increases (from 4 to 6 percent); we also observe moderate increases (never more than 2 percent) in the share of calories consumed while relaxing at home, watching television, caring for others, or shopping. Among people that are not overweight, the largest change is with respect to the share of calories consumed when socializing (from 5 percent to 12 percent); there are also increases in shares of calories consumed while working (3 percent increase) and while doing chores (2 percent increase). Interestingly, people that are not overweight tend to eat a smaller share of their daily calories while in front of the television, or while relaxing at home, on high-calories days.

We finish with a very preliminary attempt at more directly testing for the idea that secondary eating might indeed be more "mindless" than primary eating. Because of space constraints, we focus on contrasting

[11]Note that the relationship between individual BMI and total daily calories is very weak in these data. The median overweight woman consumed 1942 calories on the recall day, while the median non-overweight woman consumed 1866 calories on the recall day. Means are 2067 and 2051 respectively.

"eating only" episodes with the eating that takes place while watching television. Our test consists in relating how many calories are consumed during either a television-watching episode or an eating-only episode to how many calories people were consumed in prior hours. Under the view that eating in front of the television is more "mindless," we hypothesize that prior eating will be less of a factor in determining how much people eat while watching television than when focusing on what they are eating.

Our results are presented in Table 3. The unit of observation is a time-use episode and the dependent variable in all regressions is the number of calories consumed during that episode (including zeros). The sample in columns 1, 3 and 5 are all "eating only" episodes in the time use data; the sample in column 2, 4 and 6 are all "television watching" episodes in the time use data. We summarize prior eating with how many calories were consumed in the preceding 4 hours (nothing, less than 600 calories, or more than 600 calories), or the preceding 2 hours (nothing, less than 300 calories, or more than 300 calories), or the preceding 6 hours (nothing, less than 800 calories, or more than 800 calories).[12] We include controls for the duration of the activity (mean is 27 minutes for "eating only" episodes, 73 minutes for "tv watching" episodes), and dummies for hour of the day. In all regressions, the missing category for prior calories consumed is the intermediate category.

Table 3 shows that people that have not consumed any calories over the last 4 (columns 1 and 2), last 2 (columns 3 and 4) or last 6 hours (columns 5 and 6) eat more during the time use episode. This is true for both "eating only" episodes and "television watching" episodes. The most striking finding in Table 3 is that whether people ate a moderate or a larger amount in the prior 4, 2, or 6 hours does not seem to affect how much they eat in front of the television. In contrast, people that already ate large amounts in the prior hours eat much less during an "eating only" episode.

[12] More precisely, we sum all calories consumed across all the time use episodes that started at most 4, 2or 6 hours prior to the current episode. The 600, 300 and 800 thresholds respectively correspond to about the 75th percentile of the distributions of calories consumed in the preceding 4, 2 and 6 hours, across all current episodes.

While this is a very coarse preliminary test that needs to be refined and extended to other time use categories, the patterns we observe are strongly consistent with the idea that secondary eating might be more “mindless” (or at least less related to how hungry or full one should feel because of prior eating) than primary eating.

IV. Conclusion

Because technology has made it so much easier to consume food in any place and at any time, secondary eating may be a much more relevant phenomenon today than it was in the past. Understanding better how people consume when their mind is not solely focused on food may therefore be an important piece of the puzzles that surround the rise in obesity over the last few decades. In future work, we plan to better understand the drivers of secondary eating. In particular, we have collected rich data on individual-specific levels of overall well-being, self-control and stress; it will be interesting to see whether secondary eating behaviors are systematically related to these individual characteristics. We also plan to empirically explore the relationship between high frequency mood changes and both primary and secondary eating over the course of the day. The rich data we have collected on how people feel (both positive and negative affects) as they are engaged in various activities will allow us to track how mood swings relate to eating behavior.

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Table 1: Time Use and Calories Consumed

Activity:	Time Use (in minutes)			Calories		
	All days	Mo-Fr	Sat-Sun	All days	Mo-Fr	Sat-Sun
Eating/drinking only	57.1	53.0	69.4	922.3	858.7	1115.7
Sleeping	493.0	482.3	525.7	27.5	30.5	18.6
Personal Care	55.7	56.2	54.2	60.0	53.4	80.0
Working	147.5	177.2	57.0	112.3	137.6	35.3
Home Production	158.2	154.5	169.5	195.5	199.3	184.0
Caring	45.5	45.9	44.4	56.8	62.5	39.5
Education	12.1	13.0	9.0	10.8	14.3	0.0
Travel	79.2	82.0	70.5	127.5	128.8	123.6
Relaxation and leisure (excluding TV and attending events)	80.1	79.4	82.4	97.2	100.2	88.0
Watching TV	167.7	163.5	180.2	221.3	234.2	182.0
Attending art and sports	4.0	3.0	7.1	8.5	8.8	7.9
Socializing	50.2	46.1	62.7	111.7	82.9	199.3
Sports and exercise	11.5	11.1	12.9	4.3	3.9	5.6
Phone	14.8	15.8	11.8	25.9	26.1	25.3
Shopping	24.7	23.1	29.3	28.4	30.5	22.1
Services	12.7	13.8	9.1	14.1	16.6	6.5
Voluntarty/Civic/Religious Activities	16.7	11.1	33.7	3.9	2.6	7.8
NA	8.4	8.0	9.8	17.0	12.2	31.5

Table 2: Relationship between Total Daily Calories and Fraction of Calories Consumed while "Only Eating"

Dependent Variable: Fraction of Total Daily Calories Consumed while "Only Eating"					
Sample:		All		BMI>25	BMI<=25
	(1)	(2)	(3)	(4)	(5)
Log(total daily calories)	-0.046				
	[0.035]				
More than 2500 calories		-0.084			
		[0.034]*			
More than 3000 calories			-0.134	-0.155	-0.106
			[0.047]**	[0.061]*	[0.077]
Sample Size	397	397	397	231	154
R-squared	0.06	0.07	0.07	0.08	0.11

Table 3: Television Watching and Mindless Eating

Dependent Variable: Calories Consumed During Time Use Episode						
	(1)	(2)	(3)	(4)	(5)	(6)
Time Use Episode is:	Eating Only	TV	Eating Only	TV	Eating Only	TV
No calories in 4 previous hours	36.575	101.607				
	[28.665]	[29.347]**				
More than 600 calories in 4 previous hours	-240.252	-18.111				
	[29.906]**	[14.815]				
No calories in 2 previous hours			75.27	55.162		
			[33.661]*	[20.156]**		
More than 300 calories in 2 previous hours			-273.147	-23.816		
			[33.250]**	[17.608]		
No calories in 6 previous hours					91.385	110.431
					[35.407]*	[37.097]**
More than 800 calories in 6 previous hours					-150.674	1.409
					[38.753]**	[15.468]
Observations	780	869	714	834	795	879
R-squared	0.28	0.18	0.34	0.17	0.26	0.16