Results

Estimation results, the Hausman test statistic comparing the FE-IV results to the FE results, and the Godfrey-Hutton test for overidentification are reported in table 2. In three out of the four models, the high values on the Hausman tests indicate that there are systematic differences between the instrumental (IV) and non-IV estimates. For estimation of the HMI-2005 scores, we cannot reject the hypothesis that the FE-IV estimates do not differ significantly from the FE estimates. However, the results of the FE-IV model are still consistent under the null hypothesis. Thus, we focus on the FE-IV estimates and discuss only those results that are statistically significant at the 5-percent level or above. However, we are more confident of our model's estimating changes in calories and changes in diet quality using the HMI score because the higher values of the Godfrey-Hutton test indicate that the models for SoFAAS and HMI-2005 may be overidentified, meaning that not all of the instruments are valid.

The interaction terms make it difficult to judge the impact of time between meals and eating food away from home by simply looking at the estimated coefficients. Thus, we ran simulations using the sample means and changing variables of interest to measure the impact of changing specific variables.[16]

Our results indicate that increasing the interval between meals will have a significant impact on consumption volume and diet quality. In general, as the time interval between eating occasions increases, the calories consumed at the latter meal increase, nutritional quality (HMI, HMI-2005) of that meal decreases, and consumption of discretionary calories (SoFAAS) rises. Our estimates suggest that going 5 hours between meals instead of 4 adds about 52 calories for someone on a diet of 2,000 calories per day; extending that interval from 4 to 6 hours would add about 91 calories. The impact on diet quality is also significant. Recall that a higher HMI or HMI-2005 implies a more nutritious meal or snack and a higher SoFAAS score indicates fewer discretionary calories consumed. Using the HMI score, going from 4 to 5 hours is estimated to reduce diet quality by 0.4 point, while going from 4 to 6 hours lowers this score by 0.6 point. Using the HMI-2005 score, these same changes in the timing between meals lead to a 0.75- and 1.25-point reduction in HMI-2005 score and a 1.7- and 2.7-point reduction in the per-meal SoFAAS score (out of a total score of 20).

The location at which someone makes his or her food choices (share restaurant food) and when these choices are made significantly affect what and how much is consumed. Not surprisingly, people are estimated to eat more caloric meals when eating foods from a restaurant compared with foods prepared at home—about 107 more calories per meal. They also consume more discretionary calories (solid fats, alcohol, and added sugars) when eating meals away from home—our estimates indicate an individual's SoFAAS score would fall by 2 points when eating away from home.

A surprising finding, however, is that overall diet quality is estimated to significantly improve when eating foods prepared away from home. The HMI estimates suggest that meals away from home would add about 5 points

[16]For all simulations, we assume the respondent scores 75 on the knowledge index, works 40 hours per week, has gone 4 hours between meals, and eats all of his or her foods at home. We use mean values for meal name and weekend. We then change each assumption to estimate the effect of changing values of interest.

Table 2

Estimation results

FE-IV Estimates[a]	Calories	Healthy Meal Index	Healthy Meal Index 2005	SOFAAS per meal
	Parameter estimates (Standard errors)			
Interval	3.384**	-1.417**	-2.351*	-3.463***
	(1.637)	(0.599)	(1.227)	(0.945)
Interval^2	-0.305***	0.109***	0.137*	0.313***
	(0.0957)	(0.0353)	(0.0718)	(0.0553)
Share restaurant food	0.133***	0.0216***	0.0249*	-0.0296***
	(0.0185)	(0.00686)	(0.0140)	(0.0108)
Brunch	2.935**	0.668	-0.310	-0.0938
	(1.208)	(0.444)	(0.906)	(0.698)
Lunch	5.494***	2.866***	2.869***	0.330
	(0.931)	(0.342)	(0.703)	(0.542)
Dinner	12.46***	4.843***	4.658***	-0.412
	(0.947)	(0.348)	(0.713)	(0.549)
Snack	-8.103***	-0.0609	-4.961***	-0.957***
	(0.564)	(0.207)	(0.426)	(0.328)
Interval*knowledge	0.00784	0.00453	0.00715	-0.00613
	(0.0176)	(0.00639)	(0.0131)	(0.0101)
Interval*work hours	0.0289***	-0.00782**	-0.00402	-0.0141**
	(0.0102)	(0.00376)	(0.00767)	(0.00591)
Sharefafh*knowledge	-0.000730***	-0.000340***	-0.000670***	-0.0000397
	(0.000247)	(0.0000914)	(0.000187)	(0.000144)
Sharefafh*work hours	-0.000610***	0.00000157	0.000286***	0.000268***
	(0.000139)	(0.0000515)	(0.000105)	(0.0000811)
Weekend	1.431***	0.00916	-0.795***	-0.628***
	(0.246)	(0.0904)	(0.185)	(0.142)
Constant	8.153***	4.085***	42.85***	21.05***
	(1.846)	(0.678)	(1.384)	(1.066)
Overall R^2	.2911	0.0724	0.0704	0.0159
Sample size	35,151	35,835	35,452	35,452
Hausman Test Statistic[b]	32.32***	25.95***	14.60	66.36***
Godfrey-Hutton J-statistic[c]	7.03	0.00	10.64**	31.91***

Note: Instruments: Time of eating occasion, lagged values of each endogenous variable. *** p<0.01, ** p<0.05, * p<0.1

[a] Endogenous variables: Interval, Interval^2, Interval*knowledge, and Interval*work hours.

[b] H0: Difference between FE and FE-IV estimates is not systematic.

[c] H0: All of the instruments are valid.

to one's total daily HEI score, whereas the HMI-2005 suggests a meal away from home would add 3 points compared with meals at home.

People eat more at brunch, lunch, and dinner than at breakfast. Lunch and dinner are also estimated to significantly add to daily diet quality—both the HMI and HMI-2005 scores indicate lunches were almost 3 points higher than breakfast, and dinners were over 4 points higher than breakfast. Food consumed as snacks is significantly smaller compared to other eating occasions, but may lower diet quality—both the HMI-2005 and the SoFAAS were significantly lower for snacks.

Examining the interaction of dietary information and visceral factors provides mixed support for our theoretical hypotheses. In all cases, the coefficient on the interval*knowledge variable is not significant. One way to interpret this would be that dietary knowledge has no impact on one's reaction to longer intervals between meals. Or, the length of the interval between meals may have no effect on the relationship between dietary knowledge and food choices.

In support of our hypothesis, however, we find that our proxy for time pressures interacts significantly with the interval between meals (interval*work hours). Our estimates suggest that people who work more hours in a week are also more influenced by the interval between meals than those who work fewer hours. As an individual who works more hours in a week goes longer between meals, he or she will choose a meal that is significantly higher in calories, higher in discretionary calories, and lower in diet quality, as measured by the HMI-2005. At 4 hours between meals, an individual who works 40 hours a week is estimated to eat about 20 percent more calories than someone who is not employed. At 8 hours between meals, the fully employed individual is estimated to eat nearly 40 percent more calories than someone who is not employed.

We also find that a situational change in caloric intake and diet quality is more pronounced among individuals who are less informed about diet and nutrition. A person with a knowledge score of 50 is estimated to increase per-meal caloric intake by about 28 percent when eating away from home, while a person whose score is 100 points is estimated to eat about only 12 percent more calories when eating away from home. Using the 1994-96 measure of diet quality, we find that increasing health information is associated with making healthier choices, both at home and away from home. When eating at home, a person with a knowledge score of 100 scores about 1 point higher on the HMI than someone with a score of 50. However, this difference falls to 0.8 point when eating away from home. This may be because information about nutrient content is more difficult to obtain on foods prepared away from home.

However, when using the HMI-2005 to measure diet quality, we find that diet quality responds differently to knowledge depending on whether a person is eating at home or away from home. At home, a person who scored 100 on the knowledge index scored about 1.43 points higher than someone who scored 50 on the knowledge index. Away from home, however, the person with a perfect knowledge score was estimated to score nearly 2 points lower on the HMI-2005 than someone who scored 50 on the knowledge

index. However, it should be noted that in all cases—calories, HMI, and HMI-2005—the estimated effect of this variable is relatively small and not statistically significant.

Contrary to our theoretical hypothesis, the interaction between hours worked and eating away from home was estimated to significantly improve diet choices (share restaurant food*work hours). While individuals who are fully employed are again estimated to eat more calories at each meal than individuals who are not, this difference shrinks as the share of food away from home increases. When eating at home, individuals who work 40 hours a week are estimated to eat about 92 calories more per meal than those who worked 0 hours. When eating away from home, this difference shrinks to 43 calories per meal. Thus, we find that people who report working more hours away from home are also better able to make healthful choices when eating out, perhaps because it is something they do more regularly.

Conclusion

The sharp increase in overweight and obesity among Americans has occurred concurrently with increased awareness and publicity regarding the benefits of a healthy lifestyle. Examining this phenomenon provides an opportunity to incorporate elements of behavioral economics into consumer food choice analysis. In such analysis, both long-term health objectives and short-term situational factors drive individuals' food choices.

The interaction among these long-term goals and short-term situations can then explain seemingly time-inconsistent choices. The resulting theoretical model predicts that when individuals are experiencing strong visceral influences, such as hunger or stress, their information about health and nutrition will have less impact on their actual food choices. It also predicts that individuals who are less informed about health and nutrition, or consume more food prepared away from home, will be more likely to eschew their longrun goals when faced with short-term situational factors such as hunger. The value of this model is that it explicitly identifies elements that increase demand for goods and services that offer more immediate gratification.

The empirical results confirm that incorporating findings from behavioral economics into the analysis of nutrient intake illuminates how situational factors and long-term health objectives affect our food choices. Specifically, when individuals extend the period between meals or consume more of their food away from home, they are significantly more likely to consume more calories at each eating occasion. Going longer intervals between meals, especially when working more hours in a week, also reduces the diet quality of specific meals.

This study also suggests that in the face of visceral influences, one's intentions may have little to no impact on actual food choices. As people change their dietary goals based on prevailing nutritional beliefs, situational factors like hunger and time pressures will continue to interfere with their long-term health objectives. Making specific reference to such situations and suggesting ways to mitigate their effects should enhance the usefulness of educational campaigns designed to improve diet quality. For example, encouraging consumers to take more active control in limiting the interval between meals and choosing nutrient-dense snacks, such as fruits and vegetables, may help them better align their intentions to eat well with their actual behavior. Limiting intake of foods prepared away from home is also estimated to significantly decrease caloric consumption. Thus, another possibility would be to encourage individuals to plan ahead or seek out information about nutrient and caloric content of foods prepared away from home.