Interaction of Profit Motives, Food Marketing and Behavioral Food Decisions

I. Introduction

Over the past 40 years, obesity and overweight have become a widespread health issue in the U.S. and abroad. Many blame single factors as the primary cause of the rise in obesity. Some point toward the decreasing relative price of calorie-dense food (Chou, Grossman and Saffer, 2004), while others point to food marketers—who may take advantage of people's behavioral reactions to food (Smith, 2004). For example, Cutler, Glaeser and Shapiro (2003) find the availability of fast food has a bigger effect on weight than decreasing prices. Additionally, some have noted that serving sizes in the home and elsewhere have increased substantially over the last 75 years (Wansink and van Ittersum 2007), potentially leading individuals to consume more within each sitting.

While each of these factors might contribute to increased consumption, such observations only remove us one step from the problem. For example, larger portion sizes should not necessarily lead consumers to eat more. If they understand the change in portion size and have full control of their actions, they could simply buy less frequently. It is not clear that such a scenario would lead to increased profits for food marketers. If a change in the food marketplace has directly contributed to the increase in obesity, what drove the change in the marketplace? Have individuals truly changed their preference for portion sizes and hence body size? Or, are the underlying causes more subtle?

To illustrate this point, we propose a model of portion size selection within the market place. Using established stylized facts from food psychology, we model the consumer assuming a dual decision process model. Consumers who are cognitive resource rich may focus their attention on typical economic variables that are associated with deliberate thought – prices, and

health information. Those who are cognitive resource poor will be influenced more heavily hedonic attributes of the foods – taste, instantaneous pleasure, convenience, relative consumption norms and smell. Thus, portion sizing may be directly related to distractions that affect cognitive resources. Food marketers take account of consumer behavior as well as the likelihood of deliberate thought when determining which portion sizes to offer.

Our model implies portion sizes for sinful foods will increase with distractions. We show individual decisions on consumption and package size are related to time pressures and the types of distractions in individuals' eating environment. Further, the model has implications for placement and marketing of "healthy" versus "unhealthy" foods. Importantly, our model suggests that fat taxes and other monetary incentives may have little impact on consumer behavior. Alternatively, policies dealing with work conditions and hours worked may have a greater impact on overall obesity levels.

II. Food Psychology and Portion Sizing

A robust literature has developed to explain the psychology of food decisions (for a full review see Wansink, 2004). This literature documents how subtle factors can wield tremendous influence over what and how much people eat. Further, the majority of these factors operate in such a way that a consumer is unaware of their influence. Instead, consumers will mention price, health concerns, taste, or convenience as factors influencing their decisions.

 Many food decisions are made without much thought – as one is in a rush to get to a meeting, or between commercials of a television program. At such times, individuals may be short of the decision resources that could inform their decision process. Even with greater decision resources, however, biased psychological factors are likely to influence decisions. Food psychologists find that consumption choices are governed primarily by the eating environment

and the food environment (Wansink, 2004). The *eating environment* is defined as the individuals' surroundings when consuming food. The *food environment* is defined as the immediate surroundings of the food to be eaten. Factors within the eating environment often impact the duration of an eating episode, as well as the choice of which foods to eat. These factors include such things as lighting, odor, or noise. Distractions within the eating environment can also play an important role by defeating the individual's ability to monitor how much they have consumed. These distractions can include television, books, or conversation with others, or pre-occupation with work (cf. Wansink 2004). Factors within the food environment that affect consumption include the package size, packaging, and attributes of the food itself that may suggest what are "normal" amounts to select and consume.

We suppose that the decision maker evaluates each stimulus using two separate mechanisms: one based on affect and one based on cognitive factors. Which decision mechanism prevails depends on the amount of cognitive resources available. Thus, those with greater cognitive resources will base decisions on cognitive factors, while those with fewer decision resources will base decisions on affect. Additionally, we suppose that cognitive resources will be diminished by distractions or time pressure. We will refer to these factors as the eating environment. If the eating environment limits the cognitive resources available for decision-making, the individual will rely more heavily on consumption norms than on cognitive factors such as price or health concerns.

III. A Model of Distracted Portion Sizing

We suppose that utility is separable between cognitive and affective utility,

$U = \phi u_c(p,q) + (1-\phi) u_a(q \mid x)$, where $u_c(\cdot,\cdot)$ represents cognitive utility, $u_a(\cdot \mid \cdot)$ represents affective utility, p is price, q is consumption, and $\phi \in [0,1]$ represents the impact of the eating

environment (distractions, social gathering, etc.). The variable x represents the factors in the food environment that may affect the perception of consumption norms. For example, x may represent the package size. A larger package size will suggest a higher consumption norm leading to greater consumption of the good.

Cognitive utility represents the deliberative evaluation of long term consequences. Thus cognitive utility takes into account the impact of price on future consumption, and the impact of food consumption on health or other long term consequences. Affective utility measures the utility one derives from taste or pleasure which may be affected by cues in the food environment that suggest what a normal portion size is.

Seldom are foods offered in continuous amounts. Rather, the consumer can choose between discrete bundles of food, the size offerings being determined by the food marketer. Thus, the consumer solves

$$\max_{q \in [0,s], s \in S} U = \phi u_c(p_s, q) + (1-\phi) u_a(q \mid s),$$

where S is the set of sizing options (which must include 0 at $p = 0$), and p_s is the price of sizing option s. The q that solves this problem will either occur where

(1)
$$\phi \frac{\partial}{\partial q} u_c(p_s, q) + (1-\phi) \frac{\partial}{\partial q} u_a(q \mid s) = 0,$$

or where $q = s$. We assume a homogeneous set of consumers, for which we can examine a representative. Let $q^*(s, p_s)$ solve (1), thus

(2)
$$\frac{dq^*}{ds} = -\frac{(1-\phi) \frac{\partial^2}{\partial q \partial s} u_a(q \mid s)}{\left[\phi \frac{\partial^2}{\partial q^2} u_c(p_s, q) + (1-\phi) u_a{}''(q \mid s) \right]},$$

The denominator of (2) must be negative to satisfy second order conditions. The numerator of (2) is the second order effect of increasing portion sizes on affective utility holding consumption constant. Increasing the portion size while holding consumption constant places consumption further below the consumption norm, thus decreasing affective utility, thus (2) is positive.

For ease of exposition, we assume only one package size is marketed. The marketer, thus, wishes to solve

$$\max_{s,p} p - c(s)$$

subject to

(IR) $\qquad \phi u_c\left(p_s, \min\{q^*(s,p),s\}\right) + (1-\phi)u_a\left(\min\{q^*(s,p),s\} \mid s\right) > \underline{U} .$

The IR constraint ensures that the individual will buy the manufacturers product rather than the next best alternative. If cognitive utility is based upon the physical requirements of the body, adjusting price should have no effect on marginal utility of consumption, ceteris paribus. Thus, we assume $\dfrac{\partial^2}{\partial q \partial p_s} u_c(p_s,q) = 0$ (A1). We also assume that increasing price always decreases the maximized utility, or

$$\phi \frac{\partial}{\partial p_s} u_c\left(p_s, q^*(s,p_s)\right) + \frac{\partial}{\partial q}\left[\phi u_c\left(p_s, q^*(s,p_s)\right) + (1-\phi)u_a\left(q^*(s,p_s) \mid s\right)\right]\frac{\partial q}{\partial p_s} < 0 \ \ (A2).$$

If A2 holds, then IR will always bind. If A1 and A2 hold, then, without loss of generality, we can let $\dfrac{\partial}{\partial p} u_c = -1$, so that utility of consumption is money metric. We can now restate the problem as

(1.4) $\qquad \max_s \phi u_c\left(\min\{q^*(s),s\}\right) + (1-\phi)u_a\left(\min\{q^*(s),s\} \mid s\right) - \underline{U} - c(s)$

The solution to (1.4) falls under two possible contingencies: 1) where the consumer is satiated, and consumes $q^*(s)$, or 2) where the consumer is unsatiated and consumes s.

Given that $\frac{\partial}{\partial s}U_a(.|.) < 0$ and $c'(s) > 0$, the consumer will be unsatiated under the solution to (1.4). To see this, note that if the consumer is satiated, then the first order conditions resulting from (1.4) can be written as

$$(1.5) \qquad \phi u_c'(q^*)\frac{dq^*}{ds}+(1-\phi)\left[\frac{\partial}{\partial q}u_a(q^*|s)\frac{dq^*}{ds}+\frac{\partial}{\partial s}u_a(q^*|s)\right]-c'(s)=0.$$

The first order conditions of the consumer problem allow us to rewrite (1.5) as

$(1-\phi)\frac{\partial}{\partial s}u_a(q^*|s)-c'(s)=0$, which is a contradiction. If instead the consumer is unsatiated, then the first order conditions resulting from (1.4) can be written as

$$(1.6) \qquad \phi u_c'(s)+(1-\phi)\left[\frac{\partial}{\partial q}u_a(s|s)+\frac{\partial}{\partial s}u_a(s|s)\right]-c'(s)=0.$$

In this case, imposing the consumers first order condition requires that

$\phi u_c'(s)+(1-\phi)\frac{\partial}{\partial q}u_a(s|s) > 0$. All remaining terms of (1.6) must be negative, and (1.6) must be decreasing in s. Thus the optimal package size leaves the individual strictly unsatiated, in that she wants to eat more at the time of consumption, and the optimal package size is determined by (1.6).

Totally differentiating (1.6) obtains

$$(1.7) \qquad \frac{ds}{d\phi}=-\frac{u_c'(s)-\left[\frac{\partial}{\partial q}u_a(s|s)+\frac{\partial}{\partial s}u_a(s|s)\right]}{\phi u_c''(s)+(1-\phi)\left[\frac{\partial^2}{\partial q^2}u_a(s|s)+2\frac{\partial^2}{\partial q\partial s}u_a(s|s)+\frac{\partial^2}{\partial s^2}u_a(s|s)\right]-c''(s)}$$

The denominator of (1.6) will be negative under standard regularity assumptions. Hence $\frac{ds}{d\phi}$ is

positive if

(1.7) $$u_c{'}(s) > \frac{\partial}{\partial q} u_a(s \mid s) + \frac{\partial}{\partial s} u_a(s \mid s)$$

and negative otherwise. Thus if the marginal affective utility is relatively larger than the

marginal cognitive utility plus the marginal normative effect, more distractions (or fewer

decision resources) will lead to larger package sizes.

Define *sinful* foods as those with a relatively larger marginal affective utility (as given by

(1.7), and *virtuous* foods as those with a relatively larger marginal cognitive utility. Sinful foods

represent items that are desired for their taste rather than health and nutrition qualities. Virtuous

foods are desired more for their marginal contributions to health and nutrition than their taste.

This leads us to two important hypotheses regarding serving sizes and cognitive resources. First,

as cognitive resources decrease, equilibrium portion sizes will increase for more sinful foods and

decrease for virtuous foods. Second, as cognitive resources decrease, uniformly more sinful

items will be marketed. This results from the profit maximizing equation (1.4). As cognitive

resources decline, smaller portion sizes for virtuous foods decreases the price, and hence the

profit obtained from virtuous sales. Alternatively, profits increase for sinful foods leading to

more and more sinful items being offered for sale.

IV. Portion Sizes and Distractions

To test the underlying behavioral assumptions of our model, we observed 408 movie goers at an

upstate New York theater, recording the movies they watched, what foods they purchased and at

what times, and how much was consumed. Table 1 displays the proportion of consumers

ordering various sizes of popcorn by the time when they purchased. Notably, those ordering their

food less than five minutes before the movie started or after the movie started were approximately three times as likely to order the large popcorn. This result is significant and remains of a similar size and significance when controlling for age, gender and body mass index. Thus those who may feel time pressure do appear to lean towards purchasing larger portion sizes. No significant differences were observed for smaller sizes.

In line with previous research (e.g., Furnham, Gunter and Walsh 1999), we suppose that comedies require greater involvement by an audience. Cognitive resources may be necessary in order to make sense of punch-lines—suggesting more distraction when eating popcorn. Table 2 displays the average number of handfuls of popcorn consumed (total and per minute) both before and during a movie for those attending comedies and other films given the purchase of a large popcorn. During the movie, moviegoers consumed more than twice as much per minute when watching a comedy than another genre of movie. This difference is significant, and remains so when controlling for age, gender, body mass index, or if this individual purchased a drink. Interestingly, there is no significant difference in consumption among these groups prior to the beginning of the movie.

Next we turn to marketplace implications. Nielson and Popkin (2003) use nationally representative surveys to estimate portion sizes for various foods for the time periods from 1977 through 1998. From their study we selected the data regarding hamburgers and cheeseburgers and display consumption trends in full service restaurants and in fast food restaurants in Figure 1. We choose this particular comparison because we feel justified in arguing that cheeseburgers are relatively more affective than hamburgers. Figure 1 also displays trends in the average duration of a single episode for eating, working, leisure and television watching. Notably, the duration of an episode has increased for nearly all activities except eating. Thus, people are working and

playing in longer stretches and might be pressed for time in eating, or eating while engaging in some other primary activity. Over the same time, the size of cheeseburgers has increased relatively more than hamburgers in both full service and fast food restaurants. Thus Figure 1 suggests anecdotal support for our hypotheses.

V. Conclusion

We find some evidence that distractions may play an important role in the food marketplace – both in driving portion size decisions of marketers and consumers. If the increase in portion sizes has resulted from an increasingly distracted market, it may be unlikely that fat taxes or health information may influence consumer behavior substantially. In this case, policy-makers may need to look more deeply for the root causes of increasing obesity levels. Perhaps policies should target working conditions commute times, or other factors that may unconsciously affect consumer choices.

VI. References

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Figure 1. Percentage Increase in Portion Size and Distraction Indicators Relative to 1975/1978
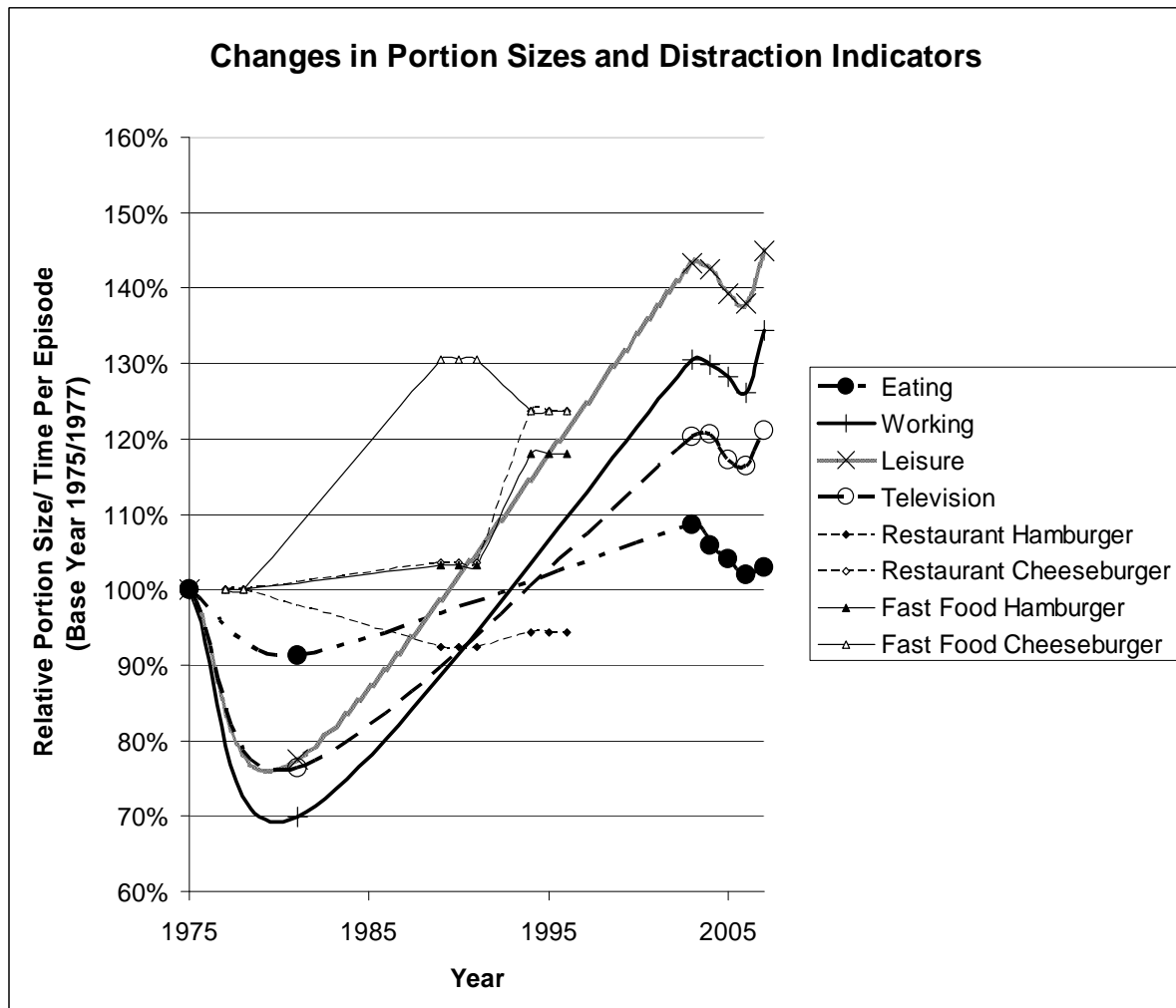
Source: Portion size data are derived from Neilson and Popkin (2003), time use data are derived from Time Use Longitudinal Panel Study of the Inter-university Consortium for Political and Social Research for 1975 and 1981, and from the American Time Use Survey of the U.S. Bureau of Labor and Statistics for 2003 through 2006.

Table 1. Popcorn Portion Size Selection by Time Relative to the Movie Start Time

	Proportion of Patrons Ordering			
Purchase Time	**Small**	**Medium**	**Large**	**Observations**
More than five	0.19	0.20	0.11	
minutes prior	(0.39)	(0.40)	(0.31)	n = 328
Less than five	0.34	0.25	0.29	
minutes prior	(0.48)	(0.44)	(0.46)	n = 59
During movie	0.24	0.29	0.33	
	(0.44)	(0.46)	(0.48)	n = 21
Significance	$\chi^2(3) = 3.41$	$\chi^2(3) = 0.92$	$\chi^2(3) = 7.06$	
	$p = 0.18$	$p = 0.63$	$p = 0.03$	n = 408

Table 2. Average Handfuls of Popcorn Consumed by Movie Type[a]

Movie Genre	During Movie		Prior to Movie	
	Total Handfuls Consumed	Handfuls per Minute	Total Handfuls Consumed	Handfuls per Minute
Comedy	51.33	0.48	17.28	3.26
(n = 27)	(92.02)	(0.85)	(21.62)	(3.38)
Non-Comedy	27.55	0.19	15.67	2.37
(n = 44)	(36.38)	(0.26)	(15.14)	(4.54)
Significance	$F(1,69) = 2.36$ $p = 0.13$	$F(1,69) = 4.60$ $p = 0.04$	$F(1,68) = 0.11$ $p = 0.74$	$F(1,49) = 0.53$ $p = 0.47$

a. Table includes only those ordering the large popcorn. Comedies include: Baby Mama, Get Smart, Hancock, Kung Fu Panda, Mama Mia Pineapple Express, Sex and the City, Stepbrothers, The Strangers, Tropic Thunder, Wall-E, What Happens in Vegas, and Zohan. Other movies in the sample include Dark Knight, Hellboy II, The Hulk, Indiana Jones, Iron Man, Kit Kittredge, Mummy: Dragon Emperor, Tell No One, Wanted and Prince Caspian.