Theoretical Model

For this study, we use a relatively simple, two-period utility maximization problem that incorporates Loewenstein's visceral factors approach. Although a dynamic model may be more realistic, the general insights derived from a two-period model are the same. We assume that consumers make consumption decisions on a per meal basis and discount future well-being by some factor, δ, that is strictly less than one. In both the current and future periods, utility is derived from food (F), a composite nonfood item (N), and the individual's health status (H). For simplicity, we assume strong separability between food and nonfood, such that the utility received from food is not influenced by the amount of nonfood at that time. An individual's level of health, however, is assumed to complement both food and nonfood consumption. We also assume the utility function to be continuous, twice continuously differentiable, strictly increasing, and strictly concave in health, food, and nonfood items.

A vector of relevant visceral factors (α) experienced at the time an individual makes his or her consumption decision influences the level of utility received at that time. To isolate the effects of visceral factors on food consumption decisions, it is assumed that α influences only the utility derived from food consumed at that time. Holding all else constant, we assume that increasing visceral factors, such as the level of hunger experienced at the current time, will increase the marginal utility from food consumption so that an individual will require more food to provide the same level of utility compared to some neutral level of hunger. Thus, food and hunger are assumed to be complements. Individuals are assumed to be naive and treat these visceral factors as exogenous[3] so that utility in both periods is derived from consumption of nonfood items, food (which is influenced by visceral impacts), and one's current level of health.

$$U = U_1(F(F_1; \alpha_1), N_1, H_1 + \delta U_2 (F(F_2; \alpha_2), N_2, H_2). \qquad (1)$$

To isolate how individuals choose to balance immediate gratification from food against possible future health implications of these decisions, we assume that one's current health is a function of his or her past dietary choices. For simplicity, we also assume that only less healthful foods have a positive impact on current utility from food and that these same foods have a negative impact on future health. How much an individual knows about health and nutrition (η) is assumed to affect how well he or she translates poor dietary choices into future health effects. Individuals who know more about the links between diet, nutrition, and health perceive a greater health impact from an unhealthy diet than individuals who know little about diet and health. This then leads to the following health production function:

$$H_t = H_t (F_{t-1}; \eta_{t-1}) \qquad t = 1,2. \qquad (2)$$

Finally, in both the current and future periods, an individual faces the following budget constraint:

$$P_{Nt} N_t + P_{Ft} F_t = Y_t \qquad t = 1,2, \qquad (3)$$

[3]Treating visceral influences as endogenous would complicate the model without providing additional insights. Fully sophisticated individuals would control visceral influences such that their optimal choice of food would be the same as that under a state of neutral visceral influences. Loewenstein (1996, 2000) argues that while individuals do control their situations, they underestimate the effect that visceral influences will have in the future. Thus, although our theoretical model could accommodate this by allowing individuals to have an underestimated idea of their future visceral levels, the ultimate findings of our model would be the same: As visceral factors increase, individuals would consume more food and the strength of dietary information on guiding food choices would decline.

where P_{Nt} is the price of nonfood items, P_{Ft} is the price of food, and Y_t is the individual's income. Substituting the health production function (2) into (1), the Lagrangian for this two-period optimization problem can be written as:

$$L = U_1(F(F_1;\alpha_1), N_1, H_1 (F_0; \eta_0)) + \delta U_2 (F(F_2; \alpha_2), N_2, H_2 (F_1;\eta_1)) + \lambda_1(Y_1 - P_{F1} F_1 - P_{N1} N_1) + \lambda_2 (Y_2 - P_{F2} F_2 - P_{N2} N_2). \quad (4)$$

The first-order conditions for optimal consumption of unhealthful foods and nonfood items (F_1, N_1) at time 1 are:

$$L_{F1} = U_{1F1} + \delta U_{2H2} H_{2F1} - \lambda_1 P_{F1} = 0 \quad (5a)$$

$$L_{N1} = U_{1N1} - \lambda_1 P_{N1} = 0 \quad (5b)$$

$$L_{\lambda 1} = Y_1 - P_{F1} F_1 - P_{N1} N_1 = 0, \quad (5c)$$

where U_{1F1} and U_{1N1} are the current marginal utilities from food and nonfood consumed in the first period, U_{2H2} is the marginal utility from health experienced in period 2, H_{2F1} is the marginal impact of the current period's poor food choices on next period's health, and λ_1 is the current marginal utility of wealth. For simplicity, we normalize prices and set P_{N1} equal to one. To be certain that these values of F_1, N_1 yield optimal values, we require the following condition to hold:

$$|\delta U_{2H2H2} H_{2F1}| < | (P_F)^2 U_{1N1N1} + U_{1F1F1} + \delta U_{2H2} H_{2F1F1}|. \quad (6)$$

Condition (6), along with Cramer's rule, can be used to determine how F_1 will change with specific parameters, such as current visceral influences and dietary awareness, and how the effect of dietary awareness on unhealthful food choices will change with the intensity of visceral influences.[4]

[4]A detailed account of the propositions and their proofs is available upon request.

Proposition 1: $\partial F_1 / \partial \alpha_1 > 0$

Increasing visceral factors in the current period will cause an individual to choose more unhealthful foods at that time.

Differentiating equations 5a-c with respect to α_1, rewriting the system of equations in matrix form, and solving this system of three equations using Cramer's rule, we find that the optimal choice of unhealthful foods will increase in the presence of relevant visceral factors as long as food and visceral factors (hunger, stress) are complements. Since $U_{1F1\alpha 1} > 0$ is true by construction, proposition 1 holds.

Proposition 2: $\partial F_1 / \partial \eta_1 < 0$

Increasing an individual's awareness about the negative impact of poor dietary choices on future health will cause him or her to eat fewer unhealthful foods.

Using the same technique and differentiating the first-order conditions with respect to η_1 and again solving this system of equations via Cramer's rule, individuals with higher levels of health information will choose fewer unhealthful foods as long as $U_{2H2}H_{2F1\eta 1} < 0$. We assume that an individual who is more informed about the links between diet and health will be better able to assess the negative health effects of his or her poor food choices, thus

$H_{2F1\eta1} < 0$.[5] This then ensures that an individual will respond to an increase in health information by choosing fewer unhealthful foods for current consumption.

Proposition 3: $\partial^2 F_1 / \partial\eta_1 \partial\alpha_1 = \partial^2 F_1 / \partial\alpha_1 \partial\eta_1 < 0$

As visceral factors increase at a given time or eating occasion, an individual's health information will have less impact on his or her food choice. Alternatively, individuals with higher levels of health and dietary information will be less affected by visceral factors than individuals with lower levels of dietary information.

Again, differentiating the first-order conditions with respect to η_1 and then differentiating each with respect to α_1, we find that $\partial^2 F_1 / \partial\eta_1 \partial\alpha_1$ is less than zero as long as

$$\left|\delta U_{2H2} H_{2F1F1\eta1} \partial F_1 / \partial\alpha_1\right| < \left|U_{1F1F\alpha1} \partial F_1 / \partial\eta_1 + \delta U_{2H2H2} H_{2F1\eta1} \partial F_1 / \partial\alpha_1\right|. \quad (7)$$

Our goal is to sign comparative statics for a typical individual, not all mathematically possible utility and health production functions. We therefore make additional, but reasonable, assumptions. The first is that the health production function is convex—the negative effect of poor food choices on health increases as an individual's health status decreases. Another is that better dietary information is assumed to simply shift the health production function inward while leaving the rate at which poor food choices affect overall health unchanged. Thus, $H_{2F1F1\eta1} = 0$. Similarly, we can assume that increasing visceral factors simply causes an outward shift in the utility one receives from food. We can also assume that increasing visceral factors causes the marginal utility received from food to increase, but at a decreasing rate. Simply put, as visceral factors like hunger or stress intensify, additional amounts of food increase overall utility at lower rates. This conforms with the idea that many people tend to make poorer food choices when hungry or under stress. As long as we assume that $U_{1F1F\alpha1} \leq 0$, condition (7) will hold. This in turn implies that $\partial^2 F_1 / \partial\eta_1 \partial\alpha_1 < 0$.

[5]By assumption, information affects only how accurately one relates dietary choices to health outcomes. It does not have an impact on the level of enjoyment derived from health.