Foodservice Composting Crowds out Consumer Food Waste Reduction Behavior in a Dining Experiment

Danyi Qi, The Ohio State University
Brian E. Roe, The Ohio State University

Invited paper presented at the 2017 ASSA Annual Meeting, January 6-8, 2017, Chicago, Illinois.

Foodservice Composting Crowds Out Consumer Food Waste Reduction Behavior in a Dining Experiment[1]

Danyi Qi, PhD Candidate
Department of Agricultural, Environmental and Development Economics
The Ohio State University
Email: qi.163@osu.edu

Brian E. Roe, Professor
Department of Agricultural, Environmental and Development Economics
The Ohio State University
Email: roe.30@osu.edu

Pressure mounts to address food waste, which deprives hungry people of needed nutrition, depletes resources used to produce food, and accounts for substantial greenhouse gas emissions during production, distribution and disposal. Composting, and other food waste recycling technologies that divert food waste from landfills, mitigate the environmental damages of food waste disposal and grow in popularity. We explore whether consumer knowledge that the environmental damage created by their food waste will be mitigated undermines personal food waste reduction behavior. Subjects in a dining situation are randomly assigned whether or not they receive information about the negative effects of landfilling food waste and whether they are told that uneaten food from the study will be composted or landfilled. We find that providing information about the negative effects of food waste in landfills significantly reduces both the propensity to create any food waste and the total amount of solid food waste created when compared to control subjects. However, if subjects are also informed that food waste from the study will be composted, the propensity to create food waste and the amount of solid food waste generated is similar to control situation which features neither a reduction nor a recycling policy. This suggests a crowding out effect or informational rebound effect in which promoting policies that mitigate the environmental damages of food waste may unintentionally undermine policies meant to encourage individual consumer food waste reduction. We discuss key policy implications as well as several limitations of our experimental setting and analysis.

Key Words: Food waste, composting, rebound effects, supply chain, policy, economic experiments, crowd-out effect, single-action bias

JEL Codes: C90, Q18, Q53

---

[1] Funding for the research is from the McCormick Program in Agricultural Marketing and Policy, Department of Agricultural, Environmental and Development Economics, Ohio State University. Partial support for Roe's salary is recognized from the Ohio Agricultural Research and Development Center, Ohio State University.

Pressure mounts to address food waste, which deprives hungry people of needed nutrition, depletes resources used to produce food, and causes greenhouse gas emissions during production, distribution and disposal (Okawa, 2015, Parfitt, et al., 2010, Quested, et al., 2013, Quested, et al., 2013, Secondi, et al., 2015). In response to the U.S. government's announcement of a goal to cut domestic food waste in half by 2030 (USDA, 2015), the private-public group Rethink Food Waste through Economics and Data (ReFED) issued a synthesis report that articulates and assesses 27 strategies for addressing food waste (ReFED, 2016). One category of strategies – reduction strategies – engage consumers and the institutions serving consumers (e.g., food service, supermarkets) to reduce the amount of food wasted. Another category – recycling strategies – engage consumers and the institutions serving consumers (e.g., food service and local governments) to divert food scraps from landfills through technologies such as composting or anaerobic digestion. ReFED (2016) argues that reduction strategies deliver the greatest potential net economic benefits on a per-strategy basis while recycling strategies hold the greatest potential in terms of scalability and the total volume of food waste potentially diverted from landfills.

In this paper we explore possible behavioral interactions between food waste reduction and recycling strategies and assess whether the implementation of recycling strategies may undermine the effectiveness of reduction strategies. The ReFED report (2016) emphasizes that all strategies are needed to make significant progress towards national food waste reduction goals and predicts that the suite of strategies explored in the report could deliver a 20% reduction in US food waste if all strategies were fully implemented. Understanding possible behavioral interactions among the reduction and recycling strategies is crucial on two fronts. First, understanding if the proposed strategies work at cross purposes could refine the estimates of potential total reduction capacity achievable for the proposed suite of strategies. Second, understanding any mechanisms that might cause negative interactions could guide strategic implementation to mitigate any undesirable interactions.

The economics literature provides relevant examples of unintended behavioral consequences of public policies in other contexts including rebound effects (e.g., policies mandating improved energy efficiency that spur little to no reduction in energy use, e.g., Chan and Gillingham, 2015), charitable crowding-out effects (e.g., government grants to non-profits that deter private charitable donations, e.g., Andreoni, Payne and Smith, 2014), and lulling effects (e.g., policies mandating safer technologies such as seatbelts and child-resistant aspirin bottles that spurred increased consumer recklessness and little improvement in safety, e.g., Peltzman, 1975, and Viscusi, 1984). The psychology literature also recognizes the potential for a motivational crowding-out effect under the concept of single-action bias, in which people cognizant of an issue and motivated to act will often engage in only a single action to address the issue (Weber 1997, Slovic and Weber, 2002). If made aware of a policy that addresses an issue (e.g., composting undertaken by a food service provider to reduce the negative consequences of food waste), the person may count that as the 'single action' and lose motivation to undertake their own action (personal reductions in food waste).

To test the hypothesis that recycling strategies for food waste such as composting may deter consumers from implementing waste reduction strategies, we conduct a dining study. Subjects are provided a free meal and exposed to one of four randomly assigned information treatments drawn from a 2x2 experimental design that varies by (a) the receipt of information concerning the deleterious effects of food waste and the mitigating effects of composting (yes or no) and by (b) the information provided about the destination of food that remains uneaten at the conclusion of the dining study (landfill or compost). The amount of food left uneaten is carefully measured and then modeled as a function of the randomly assigned information treatment with controls for individual characteristics.

We find the receipt of the information concerning the deleterious effects of food waste and the mitigating effects of composting led to statistically significant and economically relevant reductions in food waste with 16% fewer subjects generating any waste and 58% less solid waste generated compared to controls who received information on an unrelated topic. However, if in addition to this information, the subjects are also told that uneaten food will be composted, the percent of subjects creating waste and the total solid waste generated is not significantly different from the baseline control. We find these results are robust to several different specifications and to specifications where we instrument for the compost/landfill destination treatment due to heterogeneous subject beliefs about whether the promised destination for uneaten food would really be implemented (i.e., imperfect and endogenous compliance). The results are consistent with motivational crowd-out or an informational rebound effect. That is, for this particular dining situation, the average decline in food waste due to a consumer reduction strategy is offset by an increase in food waste that occurs when a subject is made aware of a food waste recycling strategy provided by the food service institution.

The results match the predictions from a formal model of consumer ordering and consumption behavior that incorporates key facets of our dining study (food must be ordered in discrete amounts, zero marginal cost of increasing order size, a single opportunity to order food, no food may be taken away from the study). The results suggest that a possible avenue for offsetting such rebound or crowd-out effects is for food service institutions to focus consumer messaging on the benefits of reducing food waste while remaining silent to consumers about any institutional food waste recycling efforts. Hence, institutions may want to reconsider 'green promotion' efforts targeted at consumers that highlight environmentally beneficial initiatives such as food waste composting if such efforts may undermine consumer motivation to reduce waste.

The remainder of the article is organized as follows. First we provide a theoretical model of consumer behavior in a dining situation mirroring our experiment and derive a key proposition about the effect of recycling strategies to frame our empirical work. We then introduce the experimental methods and design and discuss summary statistics of the experimental data gathered. We then introduce the estimation model and discuss several challenges to obtaining consistent estimates of treatment effects. We next discuss the results and derive several policy implications. We end by discussing limitations of the experimental and empirical analysis and frame subsequent questions stimulated by the current work.

A Model of Consumer Food Ordering, Consumption and Waste

To frame the empirical analysis, we solve a diner's food ordering, consumption and wasting problem for a setting that mirrors the experiment: a free dine-out meal in which discrete units of food may be ordered once and where take-away is not allowed (i.e., no doggy bag, which implies that consumption and waste decisions become a single reciprocal decision). The diner chooses two quantities in sequence to maximize utility: how much to order (q_t) and then how much to eat (q_c). Similar to 'all-you-care-to-eat' settings, the marginal cost of q_t is zero. Hence, the diner never orders less food than he expects to eat ($q_t \geq E[q_c]$) if q_t can be chosen freely from a continuous interval that contains $E[q_c]$.

The utility from food intake is $U(q_c)$ which features a classical shape that is increasing at a decreasing rate until a saturation point at which marginal utility declines with additional food intake (i.e., there is disutility from over-eating). The diner experiences disutility (e.g, a general feeling of guilt) when food is wasted, which occurs when $q_t - q_c > 0$ in this 'no doggie bag' setting. $G(q_t - q_c)$ is the disutility of food waste, which is increasing with the total amount of waste (G'(.) > 0) and yields no disutility from zero waste (G(0) = 0). Disutility grows with a diner's awareness of food waste, $\lambda_{fw}G(q_t - q_c)$ where $\lambda_{fw} \in [0,1]$ represents the awareness level. A fully aware diner ($\lambda_{fw} = 1$) experiences the full disutility $G(q_t - q_c)$ while a fully unaware diner ($\lambda_{fw} = 0$) experiences no disutility.

At the same time, wasted food in landfills generates an extra environmental cost, $e(q_t - q_c)$, which increases with the amount of waste e'(.) > 0. This cost is mitigated by food waste recycling policies such as composting. Hence the actual environmental cost is $f(\eta)e(q_t - q_c)$ where $\eta \in [0,1]$ is the composting rate and $f(\eta) \in [0,1]$ is the mitigation effect. For simplicity, we assume that composting ($\eta = 1$) eliminates all the extra environmental costs ($f(1) = 0$), while food waste remaining in a landfill ($\eta = 0$) will generate the full environmental cost $f(0) = 1$. When $0 < \eta < 1$, part of the food waste is composted and the rest goes to a landfill. The environmental cost from wasted food is reduced as the composting rate increases ($f'(.) < 0$).

The diner internalizes the environmental cost based on his awareness of the environmental externality from wasted food in the landfill and of his awareness of the differences between the two waste management methods, composting and landfilling, ($\lambda_m \in [0,1]$). The internalized environmental cost combines the actual cost and awareness level $\lambda_m f(\eta)e(q_t - q_c)$. The diner who is unaware of the environmental externality from food waste in a landfill ($\lambda_m = 0$) doesn't internalize the extra cost and also doesn't appreciate the benefits of composting. An aware diner ($\lambda_m = 1$) fully internalizes the environmental costs of food waste destined for the landfill ($e(q_t - q_c)$), and such costs are eliminated when food waste is composted.

The diner maximizes utility by choosing q_t and q_c in sequence:

$$U(q_c) - \lambda_{fw} G(q_t - q_c) - \lambda_m f(\eta) e(q_t - q_c).$$

When the diner is fully unaware of the food waste issue $\lambda_{fw} = \lambda_m = 0$, the optimal intake maximizes his utility from food intake:

(1) $$U'(q_c) = 0.$$

Let $U'(q_c^*) = 0$, hence q_c^* is the unconstrained maximizer of $U(q_c)$ of the unaware diner in this no-storage situation. Within the context of the experiment, diners can only order items in discrete units (4 inch segments of sandwich and fixed-size bags of chips and apples). Hence, rather than choosing food quantity from a continuous interval, the diner must choose quantities from a discrete set, $q_t \in [0, q_t^1, q_t^2, \ldots, q_t^n]$. Assume the choice set does not contain the optimal amount, i.e., $q_c^* \notin [0, q_t^1, q_t^2, \ldots, q_t^n]$. Define $q_c^{min} < q_c^* < q_c^{max}$ as the quantities from the choice set that surround optimal consumption.[1] When wasting food is costless ($\lambda_{fw} = \lambda_m = 0$), the diner over-orders, i.e., $q_t = q_c^{max} > q_c^*$, eats q_c^*, and wastes the rest ($q_c^{max} - q_c^*$).

When wasting food reduces utility ($\lambda_{fw} > 0, \lambda_m > 0$), the diner may either over-order ($q_t = q_c^{max}$) or under-order ($q_t = q_c^{min}$). When the diner orders less than his personally optimal amount, $q_t = q_c^{min} < q_c^*$, he consumes all that is ordered ($q_{c\_under}^* = q_c^{min}$) and wastes zero:

(2) $$U(q_{c\_under}^*) = U\left(q_c^{min}\right) < U(q^*).$$

When he over-orders, e.g., $q_t = q_c^{max} > q_c^*$, he determines the amount of intake (q_{c_over}) to maximize utility:

(3) $$U\left(q_{c\_over}\right) - \lambda_{fw} G\left(q_c^{max} - q_{c\_over}\right) - \lambda_m f(\eta) e\left(q_c^{max} - q_{c\_over}\right) < U(q^*).$$

To maximize utility,

(4) $$U'\left(q_{c\_over}^*\right) = -\lambda_{fw} G'\left(q_c^{max} - q_{c\_over}^*\right) - \lambda_m f(\eta) e'\left(q_c^{max} - q_{c\_over}^*\right) < 0.$$

Here the diner reduces food waste by eating more than is optimal, $q_c^* < q_{c\_over}^* < q_c^{max}$. However, such an effort to reduce food waste is discouraged when the diner knows that wasted food will be composted, and hence the cost of wasting decreases:

(5) $$\frac{\partial U'(q_c)}{\partial \eta} = -\lambda_{fw} f'(\eta) e'(q_c^{max} - q_c) > 0.$$

Proposition 1: *When the diner perceives wasting food to be costly and the optimal intake level is unavailable when ordering ($q_t \neq q_c^*$), the diner will reduce food waste either by under-ordering and under-eating or by over-ordering and over-eating. However, such an effort is discouraged when the diner becomes aware of composting. Awareness of a higher composting rate encourages over-ordering and results in more food waste when food is over-ordered, which yields a crowding-out/rebound effect.*

To determine which is the constrained optimal (under-ordering to ensure zero waste or over-ordering to ensure sufficient intake), the diner calculates:

(6) $$d(\eta) = U(q_c^{min}) - U(q_{c\_over}) + \lambda_{fw} G(q_c^{max} - q_{c\_over}) + \lambda_m f(\eta) e(q_c^{max} - q_{c\_over}).$$

f the utility loss from insufficient food is smaller than the disutility from wasting food and over-eating ($d(\eta) > 0$), the diner will under-order and waste nothing. If the disutility from wasting food and over-eating is smaller than utility loss from insufficient food ($d(\eta) < 0$), the diner will over-order and waste food. A higher composting rate decreases the cost of wasting and encourages the option involving over-ordering and food waste:

(7) $$\frac{\partial d(\eta)}{\partial \eta} = \lambda_m f'(\eta) E(e(q_c^{max} - q_{c\_over}) < 0.$$

Experimental Methods

In order to explore and estimate the effect of composting, a widely proposed food waste recycling policy, an experimental study was conducted at large urban university during June and July of 2016. Participants were recruited from the university's student and staff population and from the general population of the surrounding region. To limit self-selection bias, food waste was not mentioned in the recruitment materials.

The provided lunch offered the following components: bags of chips, bags of apple slices, drinks and sandwiches of different types in 4-inch segments. The lunch was free of charge and participants could order as much as they wanted in any combination, but they could only order once (i.e., no second helpings). The sandwich segments were prepared by the research staff to ensure that all sandwich portions weighed the same (180g per 4 inches) while the remaining items were prepackaged in standardized package sizes by the manufacturer. The amount served to each diner was recorded upon serving. Upon completion of the meal the diner returned the tray individually. Research staff took the tray including all uneaten food and drink to a separate room out of visual range of the diner, where items were weighed after the conclusion of each session to determine each respondent's total solid and liquid waste and to match this to the respondent's order information. Participants completed a survey and then, upon dismissal, were provided a debriefing script describing the complete purpose of the study. The full sequence of study activities is detailed in figure A1 in the Appendix. The protocol was approved by the local Institutional Review Board.

Experimental Design

Participants are randomly assigned to one of four treatments drawn from a 2 x 2 design (table 1): (a) receive general information about the negative societal impacts of food waste and the mitigating effects of composting (yes or no) x (b) destination of any uneaten food from the study (compost or landfill). To ensure that the effects of design element (a) are not related to the extra time or cognitive effort required to receive and process additional information, those who don't receive information about food waste receive a control set of information about an unrelated topic (financial literacy).

All participants in a given dining session receive the same treatment. Multiple dining sessions were held for each treatment to ensure that results are not influenced by any particular dining session. Sessions featuring the same treatment were held on different days of the week to minimize potential confounds between day of the week effects and treatment, and only one session from the same treatment was held in any given week. All sessions were held at the same time of day (11:30 – 1:30) and the same location.

At the beginning of the session, each participant receives a Welcome Sheet explaining the terms of the study: 1) All food is free of charge; 2) Participants may only order food once though they may order as much as they want; 3) Doggy bags are not allowed, i.e., food can only be consumed at the study location; 4) No food sharing with other participants; 5) Upon completing the meal, return the tray to the research staff before picking up a survey to complete; and 6) The destination of their uneaten food is listed (compost or landfill, depending on the treatment). On all the hand-outs, we use the term *uneaten food* instead of *food waste* whenever possible (except for food waste information card and the accompanying quiz).

Respondents assigned to the first column of table 1 were informed that "…all uneaten food will be placed in the facility's normal waste baskets, whose contents are placed in local landfills…" Therefore, the perceived compost rate is zero ($\eta = 0$) and the internalized environmental cost is $-\lambda_m E(q_t - q_c)$. In sessions from the second column of table 1, participants were informed that "…all uneaten food will be sent to a compost facility so that emission of methane from the uneaten food will be largely reduced and the compost generated can nourish soil for healthier plants and gardens…” Hence, no food waste ends in landfill ($\eta = 1$) and participants internalize zero environmental cost $f(\eta) = \lambda_m f(\eta)e(q_t - q_c) = 0$. For these sessions, all uneaten food was deposited in a compost facility located on the University’s farm.

After the Welcome Sheet, an information card detailing the negative societal impacts of food waste was given to those in sessions randomly assigned to the bottom two cells of table 1 (see Appendix for the card). Such information enhances participants’ awareness of the societal cost of food waste and the differences between compost and landfill options.

If we define that the participants who read and understood the food waste information card as aware participants, $\lambda_{fw} = 1$ and $\lambda_m = 1$, they experience the full disutility from wasting food $G(q_t - q_c)$ and may fully internalize the environmental cost generated from wasted food $f(\eta)e(q_t - q_c)$. Those in the opposite treatment (top two rows of table 1) receive a similar length information card and subsequent quiz about financial literacy (see Appendix for the card). Financial literacy is unrelated to food, waste or food waste and helps ensure any estimated effects are the result of information about food waste and not just a general informational effect or an effect of the additional time delays prior to food consumption. Participants who read the information card about financial literacy may still feel bad about wasting food based on knowledge they had prior to the study. For example, one might assume $\lambda_{fw} = \frac{1}{2}$ based on a U.S survey in 2015 that found that about half of Americans are aware of recent coverage of the level of food waste or food waste reduction efforts (Qi and Roe 2016). However, aware individuals may not know the differences in environmental cost between food waste in landfills and composted food waste ($\lambda_m = 0$). As a result, they may experience a partial negative emotion of wasting food (e.g., $\frac{1}{2}G(q_t - q_c)$) and may not fully internalize any perceived environmental costs of food waste in landfill and will not appreciate the societal benefits from composting.

Based on this reasoning, representative utility functions for participants randomly assigned to each group are presented as the third line in each cell in table 1 for purposes of illustration and to guide empirical interpretation. Participants in the food waste landfill group are expected to perceive the highest cost of wasting food and are expected to waste the least, while the participants from the two financial literacy groups are expected to perceive the lowest cost of wasting food and waste the most. Participants from the food waste by compost group are in the middle. They are expected to perceive lower costs of wasting food than those in food waste landfill group and hence waste more.

To reinforce and test the information about the destination for uneaten food and the message from the information card, participants take a quiz (see Appendix). The awareness about food waste and the environmental externality of food waste in landfills is determined by their answer to the question: "Based on the information card, how does the damage from food waste in landfills compare to food waste sent to compost facilities?" The perceived composting rate is determined by the participants' answer to "Where will the uneaten food from today's lunch be placed?"

Summary statistics by treatment group are listed in table 2 along with results from tests that determine if randomization yielded participants across the four treatments with statistically similar individual characteristics.[2] The composition across treatment groups is balanced with respect to gender, race, age, urbanicity of current residence, and current recycling tendency. Further, the groups are balanced in terms of the amount of each individual food and beverage item ordered. Groups are unbalanced across several characteristic (e.g., education and employment). To best estimate treatment effects, we include demographic and order variables in subsequent regressions as control variables.

Order data includes the number of: 4-inch sandwiches (180g per sub), bags of apple slices (113g per bag), bags of chips (28.3g per bag), bottles of beverage (355ml per bottle) and bottles of water (355ml per bottle). Demographic characteristics (X_i) includes age, gender, race, education, employment, metro status of the place where the subject grew up, metro status of the place where the subject currently resides, and participant's responsibility for food shopping and meal preparation at home (Qi and Roe, 2016). Other demographic variables that feasibly affect participants' food waste behavior in this study include, participants' awareness about food waste before the study, and the participant's awareness of the purpose of this study prior to the exit debriefing. The participant's recycling frequency is also included to control for ongoing pro-environmental behaviors.

Empirical Methodology

Let y_i denote the grams of food waste for each participant *i*. Let the relationship between food waste, information treatments ($FW_i, Comp_i, FWxComp_i$), order size ($Order_i$), and participants' demographic characteristics (vector $\boldsymbol{X}_i$) be:

$$\log(y_i + 1) = \alpha + \theta_1 FW_i + \theta_2 Comp_i + \theta_3 FWxComp_i + \gamma Order_i + \boldsymbol{X}_i' \boldsymbol{\beta} + \varepsilon_i, \quad (8)$$

where the θ's and γ are coefficients to be estimated and $\boldsymbol{\beta}$ is a conformable vector of demographic coefficients to be estimated. $FW_i = 1$ if the participant received the information about the negative social impacts of food waste and mitigating effects of compost, and $FW_i = 0$ if the participant received the information card about financial literacy. $Comp_\text{i} = 1$ if participant *i* is told that all uneaten food will be composted, while $Comp_\text{i} = 0$ if participant *i* is told that all the uneaten food will be disposed of in a landfill. $FWxComp_i$ is the interaction term of FW_i and $Comp_\text{i}$.

Treatment versus Compliance

While participants are randomly assigned to treatment groups, each participant may not comply with the treatment, i.e., may not believe or internalize the information provided in the treatment. To gauge compliance with the treatment, respondents answered a quiz after receiving all information. For participants assigned to the food waste information treatment, 96% agreed that more environmental damage arises from food waste in landfills than from food waste in compost facilities. Hence, for simplicity, we define all the participants in the food waste group as compliant, i.e., participants understood and internalized the information about food waste. To denote this we say that $E[FW_i] = FW_i$.

To gauge compliance with the treatment concerning the destination for the respondent's uneaten food, we ask "Where will the uneaten food from today's lunch be placed?" For those in the compost treatments, 95% answered correctly. However, for those told that the uneaten food would go to a landfill, 16% answered incorrectly among those receiving the financial literacy information card and 34% answered incorrectly among those receiving the food waste information card. This indicates not only imperfect compliance (i.e., $E[Comp_\mathrm{i}] \neq Comp_\mathrm{i}$) but also suggests that the degree of noncompliance may be related to treatment information and raises the possibility that unobservable characteristics drive both noncompliance and food waste behavior.

To deal with the possible endogeneity of the perceived destination of uneaten food, we use instrumental variable methods in which we (1) estimate a first-stage binary model (e.g, probit) of compliance as a function of the random group assignments ($FW_i, Comp_i, FWxComp_i$) and participants' awareness about food waste before the study, (2) predict the fitted probability of believing the correct food waste destination information ($\hat{p}_i$), and (3) estimate the treatment effects using $\hat{p}_i$ as the instrument for the $E[Comp_i]$ and the interaction of $\hat{p}_i$ and FW_i as the instrument for $FWxE[Comp_i]$.

However, another estimation complication exists. The data on food waste contains a large percentage of observations featuring zero waste, and instrumental variable approaches yield inconsistent estimates for nonlinear models that correct for censoring (e.g, Tobit). The commonly used method for estimating such models, control function estimators, yields consistent estimates only when the endogenous variable is continuously distributed. Our endogenous variable, $E[Comp_i]$, is binary. Therefore, we also estimate models in which the dependent variable is binary and equals 1 if any food has been wasted and equals 0 otherwise. These models are interpreted as the effects of treatment on food waste at the extensive margin or, in other words, the fraction of respondents who failed to 'clean their plate' during the dining session.

We estimate a sequence of models for the log levels of waste as a function of the experimental treatments and then the instrumented compliance with treatment.[3] To explore the treatment and compliance effects on food waste at the extensive margin, we present a sequence of models with the binary dependent variable.

Results

Our theory suggests that the information treatments alter both the amount of food ordered and the amount of food waste. The ANOVA results from table 2 find no evidence that the amount of food ordered differs by treatment, but we also estimate a full regression model of the amount ordered with treatment effects and other relevant control variables (all results in the Appendix). We continue to find no significant treatment effects on order size, either in terms the total solid food grams ordered in levels or logs. We also test each order component separately and only find two effect estimates significant at the 10% level across eight models (order size in logs and levels for 4 food components – see Appendix).

Before discussing the regression results, observe figure 1, which plots the average of grams of solid food waste by treatment group. Those receiving the food waste information card discard significantly less food than those receiving financial literacy information (*p*<0.001), implying that information that enhances participants' awareness about food waste and discourages food wasting behavior.[4] When aware participants are told that all the uneaten food from their lunch will be composted, they waste significantly more food (*p*=0.002). This difference is insignificant among participants assigned to the financial literacy treatment (*p*=0.759). Also, no significant difference is found between the food waste compost group and the financial literacy compost group (*p*=0.195), implying that the announcement about composting offsets what is achieved by enhancing participants' awareness about food waste.

In table 3 we present the treatment effects on the log grams of solid food waste. In all the models, individual-level controls are included and robust standard errors are clustered by session. In column 1, we present ordinary least squares (OLS) estimates as a baseline. In column 2, we reproduce the analysis in column 1 using a Tobit model to correct for censoring. With random assignment, the local average treatment effect (LATE) estimated from Tobit is equal to the average effect of treatment on treated (ATT) if compliance were perfect. Compliance for *Comp* is not perfect, however. As a result, the Tobit estimation is biased and requires IV to yield the ATT (Angrist, et al., 1996). In column 3, we use instrumental variables (OLS-IV) to control for the endogenous imperfect compliance, but cannot control for censoring due to the lack of implemental IV approaches for models in which the endogeneous variable is binary.

The three models in table 3 show similar patterns. Enhanced awareness about food waste significantly reduces the amount of solid food waste. The information effect of composting is heterogeneous. The announcement about composting has no significant effect on food waste unless the participants also received the food waste information card (*FW x Comp*). For aware participants, the crowd-out/rebound effect of composting is positive and significant and the marginal effects of the two treatments offset (i.e., *FW* + *FW x Comp* = 0, see table 3 for test results). When censoring is corrected by a Tobit model or imperfect compliance is corrected by IV, the estimated crowd-out/rebound effects (*FW x Comp*) are larger compared to the ones estimate by OLS and we continue in our failure to reject that *FW* + *FW x Comp* = 0. Hence, we postulate that our current estimates provide a lower bound for the actual crowd-out/rebound effect that occurs when participants believe food waste will be composted.

The crowding out or rebound effect of composting is not significantly different from zero among participants who are unaware of the environmental externalities caused by food waste in landfills (i.e., *Comp* and E[*Comp*] coefficients are not significantly different from zero). This result reflects the theory that unaware diners don't internalize the environmental externalities of food waste in landfills; hence knowledge that food will be composted yields no behavioral response.

Table 4 presents the marginal treatment effects on solid food waste at the extensive margin by using a binary indicator of any waste generated as the dependent variable. Columns 1 and 2 presents the estimated marginal treatment effects from Linear Probability Model (LPM) and a Probit model; these results are quite similar. In column 3, we use instrumental variables to correct the endogenous compliance (LPM-IV). When participants are aware of the negative social impact of food waste, they are 39% more likely to clean their plates (no solid waste) than those receiving the financial literacy control information. However, this effort is significantly frustrated (41% more likely to waste food) when they are told that uneaten food from their lunch will be composted. As with solid waste, the net effect (*FW* + *FW x Comp*) is not significantly different than zero.

Discussion, Limitations and Policy Implications

Rebound effects are behavioral and market responses that offset the original intent or expected impact of a policy and were first derived and most clearly documented for energy conservation initiatives (Binswanger, 2001, Chan and Gillingham, 2015, Greening, et al., 2000, Khazzoom, 1980, Sorrell and Dimitropoulos, 2008). Qi and Roe (2016) derive analytical expressions for rebound effects that arise in response to food waste reduction policies and find that initiatives that reduce waste rates in supply chain links upstream from the consumer (pre-consumer initiatives) decrease the cost of food (and hence food waste) and yield potentially strong rebound effects. Other strands of the literature also identify mechanisms in which a policy stimulates behaviors that offset the desired outcomes from that policy, including crowding out effects in charitable settings (Andreoni, Payne and Smith 2014), and lulling effects from safety regulations (Peltzman, 1975, Viscusi, 1984).

Our study calibrates such an effect when consumer expected external costs from wasting food are reduced by making consumers aware of a policy in which food waste is diverted from the landfill and sent to a compost facility. The results show that, when enacted in isolation, a key reduction policy (enhancing awareness about the negative social impacts of food waste) induces participants to reduce their personal levels of food waste by 77-85% compared to a no-policy baseline. However, making participants aware of a recycling policy implemented by the food service staff has no statistically significant effect on participant food waste behavior. Further, when implemented in conjunction with the reduction policy, the announcement and awareness by participants of the recycling policy leads to no reduction in participant food waste behavior compared to the no-policy baseline.

Hence, for this dining study, we document significant behavioral responses to an announced food waste *recycling* policy that fully offset the reductions delivered by a food waste *reduction* policy. According to ReFED (2016), if significant progress is to be made in achieving food waste reduction goals, centralized recycling policies implemented by food service operators and municipalities hold the greatest potential in terms of the total amount of food waste potentially diverted from landfills. Our results suggest that in our dining study, recycling policies work at cross purposes with reduction policies when consumers are made aware that other actors will mitigate the negative environmental effects of any consumer food waste created.

This suggests that care is needed when jointly implementing food waste reduction and recycling policies in order to ensure the maximum potential environmental benefits are achieved. Specifically, it suggests that more environmental benefits may be achieved from joint implementation when consumer messaging focuses on reduction strategies and omits details and benefits of any centralized recycling strategies. While such messaging coordination is simple to implement in our dining experiment, it may be more difficult to implement in broader contexts. Centralized composting efforts require considerable effort and cost for a food service provider or municipality and may reflect institutional commitment to sustainability principals. There is a strong motivation for firms and municipalities who ‘do the right thing’ by implementing food waste recycling to promote these efforts to their consumers and the general public. However, as our study suggests, the promotion of such ostensibly desirable sustainability efforts may crowd out consumer motivation to reduce personal food waste levels.

Limitations and External Validity

While the results of this particular dining experiment appear robust, we must grapple with several limitations of the study. First, we must be aware that the magnitude of treatment effects for the *FW* information treatment may be magnified due to Hawthorne effects that naturally arise in experimental settings. Future work designed to avoid such observer effects can shed a brighter light on the magnitude of such effects. Also within the confines of the study setting, we have not conducted a comprehensive cost-benefit analysis that identifies the socially optimal policy prescription nor calculated the expected net social benefits of any policy. While we identify a behavioral regularity that shapes the efficacy and social efficiency of the suite of policy options, there is more to be done. Beyond the standard need to estimate policy costs and the relative environmental benefits of food waste reduction versus composting, we should explore possible implications for health and nutrition (e.g., does overeating driven by the awareness campaign result in weight gain and/or a reduction in the amount consumed at the next meal?).

When considering whether and how the results may translate to other food service settings, we must consider several aspects of our dining study. First, the food provided in our study is free. While some dining settings feature food with zero marginal cost (e.g., all-you-care-to-eat settings), consumers typically pay an entry fee contemporaneously (e.g., buffet-style restaurants), pay an entry fee in advance (e.g., university meal plans), or face a limit on the total amount that can be ordered (e.g., free meals at aid agencies). As Just and Wansink (2011) note, consumption and waste patterns in an all-you-care-to-eat setting may be sensitive to the size of the entry fee, as they document less waste when entry fees decline. Further, and perhaps more obviously, higher marginal food costs (i.e., charging for individual food items) will act as a natural reduction strategy by discouraging ordering and increasing the number of clean plates.

Second, study participants could order only once and could not engage in food storage. Many food service settings allow consumers to order more than once (e.g., returning to the buffet line for seconds or buying more food). Hence, it will be important to understand the frequency with which consumers use these tactics and to gauge the marginal impact on the amount of food wasted (e.g., are people more likely to not eat the food obtained during their second trip through the buffet line?). On the food storage front it will be important to understand the following: the frequency and volume of doggy bagged leftovers in dining settings, the likelihood that doggy bag contents are subsequently consumed, and the dispensation of uneaten doggy bag contents (e.g., landfill, compost, etc). Understanding each element would allow a more precise calculation of net social benefits of reduction and recycling policies in a food service setting.

Finally, the question arises if the interaction observed in our setting might translate to in-home behaviors. Particularly, would promotion of in-home composting systems undermine efforts to persuade households to reduce food waste in the first place? Home settings are distinct from foodservice settings because the consumer would be asked to implement two non-trivial changes to behavior: one involving food shopping, meal preparation and dining behavior to reduce the waste created, and then a separate set of activities to sort and manage food waste leaving the kitchen. Given limited time and motivational budgets for household members, understanding the means by which individuals prioritize available efforts to reduce the impacts of food waste will be critical for future research.

Footnotes

1. Diners may also be uncertain of q_c^* at the time of ordering (e.g., not sure how hungry they are or not sure how filling these particular food items will be). This could give rise to an expected range of possible order sizes, hence yielding another mechanism that gives rise to values similar to q_c^{min} and q_c^{max} and a set of results similar to the propositions derived here.
2. 15 observations are deemed outliers as defined by the modified recursive procedure (Selst and

Jolicoeur, 1994) and are excluded from all analyses.

3. All models are also estimated in levels and available in the Appendix. Model fit declines when models are estimated in levels, though the qualitative treatment patterns are the same and the level of significance remains similar in most cases.
4. *p*-values reported in this paragraph are from nonparametric Kruskal Wallis equality-of-populations rank test.

Tables and Figures

Table 1: 2x2 Experimental Design

Group Assignments	**Where Uneaten Food Goes**	
Information Card Content	*Base* (Financial Literacy, Landfill) $U(q_c) - \frac{1}{2}G(q_t - q_c)$	*Comp* (Financial Literacy, Compost) $U(q_c) - \frac{1}{2}G(q_t - q_c)$
	FW (Food Waste, Landfill) $U(q_c) - G(q_t - q_c) - E(q_t - q_c)$	*FW x Comp* (Food Waste, Compost) $U(q_c) - G(q_t - q_c)$

Notes: The italicized line in each cell is the abbreviated treatment name used in subsequent tables. The first term in parentheses indicates the content of the information card received while the second term in parentheses indicates the dispensation of uneaten food from the session. The line below this in each cell is the expected representative utility function for participants assigned to the treatment (see text for details).

Table 2: Summary Statistics

		Treatment Group				
Variable	*Base*	*FW*	*Comp*	*FWxComp*	Total	*p* – value
Male	31%	39%	39%	29%	33%	0.488
Race						0.224
White	66%	58%	47%	74%	64%	0.119
Black	7%	12%	11%	6%	8%	
Other	27%	30%	42%	20%	28%	
Education						0.018**
≤College grad	35%	54%	26%	36%	38%	
Graduate degree	23%	14%	16%	32%	23%	
Currently student	42%	32%	58%	32%	39%	
Employment						
Full-time	59%	54%	42%	66%	58%	0.049**
Student	30%	19%	37%	24%	26%	
Part-time	11%	26%	21%	11%	16%	
Age						0.109
18-35	69%	60%	76%	58%	64%	
36-49	18%	18%	5%	26%	19%	
50+	13%	23%	18%	16%	17%	
Metro Status: Grew up						0.125
City	33%	27%	49%	27%	32%	
Non-city	68%	74%	53%	73%	69%	
Metro Status: Resident						0.382
Campus	19%	11%	13%	14%	15%	
City	33%	38%	53%	33%	37%	
Non -city	48%	51%	34%	53%	48%	
Recycle						0.691
Whenever possible	48%	53%	45%	58%	52%	
Most of time	27%	19%	21%	21%	22%	
Occasionally or less	25%	28%	34%	21%	26%	

Variable	Base	Treatment Group FW	Comp	FWxComp	Total	p – value
E[FW][a]	N/A	95%	N/A	98%	N/A	0.391
E[Comp][b]	15%	33%	95%	96%	59%	0.000***
Responsibility for Food Preparation						0.669
Most responsible	80%	70%	76%	76%	76%	
Somewhat	15%	26%	21%	22%	21%	
Not at all	4%	4%	3%	1%	3%	
Awareness about Food Waste (before the study)						0.284
Aware	66%	56%	68%	54%	60%	
Unaware	34%	44%	32%	46%	40%	
Perceived Environmental Damage from Food Waste in Landfill Compared to Composted Food Waste (before the study)						0.317
Less or the same	18%	22%	26%	33%	25%	
More	66%	69%	55%	54%	61%	
Don't know	15%	9%	18%	13%	14%	
Awareness about the Study Purpose						
Aware	47%	47%	28%	37%	40%	0.060*
Aware		47%		47%		1.000
Aware	28%		37%			0.390
Food Order (g)						
4-inch Subs	1156	1048	1118	1110	1110	0.623
Apple	89	83	101	82	87	0.271
Chips	20	18	16	16	18	0.585
All Food	1265	1150	1235	1208	1215	0.566
Beverage	130	137	103	134	129	0.783
Water	240	218	252	226	232	0.795
Food Waste(g)						
Solid food	41	9	38	29	29	0.000***
	(79%)[c]	(51%)	(74%)	(67%)	(68%)	0.008***

		Treatment Group				
Variable	*Base*	*FW*	*Comp*	*FWxComp*	Total	*p* – value
Sandwich	27	6	21	20	19	0.000***
	(68%)	(40%)	(55%)	(56%)	(56%)	0.023**
Apple	12	2	11	9	9	0.050**
	(27%)	(7%)	(29%)	(20%)	(20%)	0.012**
Chip	1	1	5	1	2	0.093*
	(20%)	(9%)	(21%)	(14%)	(16%)	0.259
Beverages	82	43	56	44	56	0.016**
	(80%)	(47%)	(45%)	(52%)	(58%)	0.000***
N	71	57	38	85	251	
# Sessions	3	4	2	4	13	

Notes: reported *p*-values test equivalency across treatment groups using a Fisher's Exact Test for categorical variables and the *F*-test from ANOVA results for continuous variables. *a* - E[*FW*] denotes the percent of respondents that agree that the environmental cost of food waste in greater when it is placed in a landfill rather than composted. *b* - E[*Comp*] is the percent of respondents who believe the uneaten food from the session will be composted. *c* – The numbers in parentheses are the percent of observations recording zero waste. *, **, *** denotes significance at the 1, 5 and 10 percent levels.

Figure 1: Average grams of solid waste by topic of information received

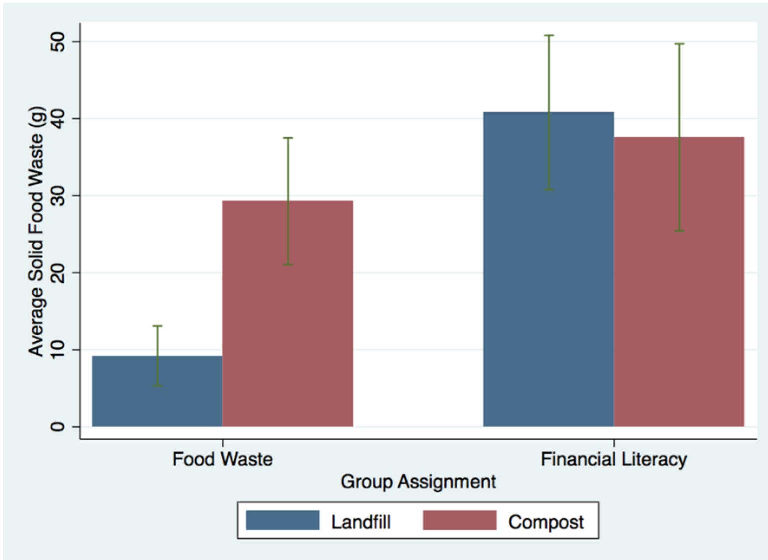


Table 3: Marginal Treatment Effects on Solid Food Waste

Dependent Variable = Log (grams of solid food waste + 1)

VARIABLES	OLS (1)	Tobit[a] (2)	OLS-IV (3)
Group Assignment			
FW	-1.503***	-1.536***	-2.137***
	(0.312)	(0. 353)	(0.504)
Comp	-0.275	-0. 205	
	(0.333)	(0. 352)	
FW x Comp	1.299**	1.310**	
	(0.560)	(0. 635)	
Compliance			
E[*Comp*]			-0.306
			(0.376)
FW x E[Comp]			2.000**
			(0.777)
p: *FW* + *FW x Comp* = 0	0.558[b]	0.548	0.682
Observations	237	237	236
R-squared	0.297		0.288

Note: Robust standard errors clustered at the session level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1 *a* – The average marginal effect of the censored prediction is reported. *b* – *p*-value from a *F*-test where the null hypothesis is *FW* + *FW x Comp* = 0 (first two columns) or *FW* + *FW x E[Comp]* = 0 (last two columns).

Table 4: Marginal Treatment Effects on Solid Food Waste at Extensive Margin

Dependent Variable = 1 if Solid Food Waste > 0; = 0 otherwise

VARIABLES	LPM (1)	Pobit[a] (2)	LPM-IV (3)
Group Assignment			
FW	-0.275**	-0.255***	-0.393***
	(0.105)	(0.864)	(0.135)
Comp	-0.074	-0. 093*	
	(0.059)	(0. 056)	
FW x Comp	0.291*	0. 290***	
	(0.135)	(0. 106)	
Compliance			
E[*Comp*]			-0.077
			(0.066)
FW x E[Comp]			0.412**
			(0.172)
p: *FW* + *FW x Comp* = 0	0.809[b]	0.494	0.764
Observations	237	237	236
R-squared	0.256		0.252

Note: Robust standard errors clustered at the session level in parentheses. *** p<0.01, ** p<0.05, * p<0.1 *a* – The average marginal effect is reported. *b* – *p*-value from a *F*-test where the null hypothesis is *FW* + *FW x Comp* = 0 (first two columns) or *FW* + *FW x E[Comp]* = 0 (last two columns).

References

Andreoni, J., A. Payne, and S. Smith. 2014. "Do Grants to Charities Crowd Out Other Income? Evidence from the UK." *Journal of Public Economics* 114:75-86.

Angrist, J.D., G.W. Imbens, and D.B. Rubin. 1996. "Identification of Causal Effects Using Instrumental Variables." *Journal of the American statistical Association* 91:444-455.

Binswanger, M. 2001. "Technological Progress and Sustainable Development: What about the Rebound Effect?" *Ecological Economics* 36:119-132.

Chan, N.W., and K. Gillingham. 2015. "The Microeconomic Theory of the Rebound Effect and its Welfare Implications." *Journal of the Association of Environmental and Resource Economists* 2:133-159.

Greening, L.A., D.L. Greene, and C. Difiglio. 2000. "Energy Efficiency and Consumption—the Rebound Effect— A Survey." *Energy Policy* 28:389-401.

Just, D.R., and B. Wansink. 2011. "The Flat-rate Pricing Paradox: Conflicting Effects of “All-you-can-eat” Buffet Pricing." *The Review of Economics and Statistics* 93:193-200.

Khazzoom, J.D. 1980. "Economic Implications of Mandated Efficiency in Standards for Household Appliances." *The Energy Journal* 1:21-40.

Okawa, K. 2015. "Market and Trade Impacts of Food Loss and Waste Reduction." *OECD Food, Agriculture and Fisheries Papers*, No. 75, OECD Publishing, Paris.

Parfitt, J., M. Barthel, and S. Macnaughton. 2010. "Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050." *Philosophical Transactions of the Royal Society B: Biological Sciences* 365:3065-3081.

Peltzman, S. 1975. "The Effects of Automobile Safety Regulation." *The Journal of Political Economy*:677-725.

Qi, D., and B.E. Roe. 2016. "Household Food Waste: Multivariate Regression and Principal Components Analyses of Awareness and Attitudes among US Consumers." PloS one 11:e0159250.

Qi, D., and B.E. Roe. 2016. "The Rebound Effect of Food Waste Reduction Policies: Theory and Evidence." Invited paper, Annual Meetings of the Agricultural and Applied Economics Association, July.

Quested, T.E., R. Ingle, and A.D. Parry. 2013. "Household Food and Drink Waste in the United Kingdom 2012." *WRAP, London*.

Quested, T.E., E. Marsh, D. Stunell, and A.D. Parry. 2013. "Spaghetti Soup: The complex World of Food Waste Behaviours." *Resources, Conservation and Recycling* 79:43-51.

Rethink Food Waste Through Economics and Data, 2016. “A Roadmap to Reduce U.S. Food Waste by 20 Percent,” available online at http://www.refed.com/downloads/ReFED_Report_2016.pdf (accessed November 4, 2016).

Selst, M.V., and P. Jolicoeur. 1994. "A Solution to the Effect of Sample Size on Outlier Elimination." *The Quarterly Journal of Experimental Psychology* 47:631-650.

Secondi, L., L. Principato, and T. Laureti. 2015. "Household Food Waste Behaviour in EU-27 Countries: A Multilevel Analysis." *Food Policy* 56:25-40.

Slovic, P., and E.U. Weber. 2002. "Perception of Risk Posed by Extreme Events." In Applegate, Gabba, Laitos, and Sachs, eds., *Regulation of Toxic Substances and Hazardous Waste (2nd edition)*, Foundation Press, St. Paul, MN.

Sorrell, S., and J. Dimitropoulos. 2008. "The Rebound Effect: Microeconomic Definitions, Limitations and Extensions." *Ecological Economics* 65:636-649.

USDA. 2015. "USDA and EPA Join with Private Sector, Charitable Organizations to Set Nation's First Food Waste Reduction Goals." Office of Communications, September 16. Available online at: http://www.usda.gov/wps/portal/usda/usdamediafb?contentid=2015/09/0257.xml&printable=true&contentidonly=true (accessed June 14, 2016).

Viscusi, W. K. 1984. "The Lulling Effect: The Impact of Child-Resistant Packaging on Aspirin and Analgesic Ingestions." *American Economic Review*, 74(2):324-327.

Weber, E.U. 1997. "Perception and Expectation of Climate Change: Precondition for Economic and Technical Adaptation." In M. Bazerman, et al. (Eds.) *Psychological Perspectives to Environmental and Ethical Issues in Management*, Jossey-Bass, San Francisco, CA.

Supplemental Appendix for Reviewers and Online Publication

1. **Welcome Sheet**
2. **Figure A1: Timeline of an Experiment Session**
3. **Figure A2: Food waste information card**
4. **Figure A3: Financial literacy information card**
5. **Quiz for FW and FW x Comp groups**
6. **Quiz for Base and Comp groups**
7. **Study Questionnaire**
8. **Tables of Supplementary Results**

Ohio State Lunch Study – Welcome!

The purpose of this study is to understand consumer eating and food handling habits during a midday meal. Hence there is no charge for the lunch, but please note:

- *You have only one chance to order food but you can order as much as you want at that time.*

- *No food from today's meal may be removed from the room.*

- *[Base & FW] All uneaten food will be placed in the facility's normal waste baskets, whose contents are placed in local landfills.*

- *[Comp & FW x Comp] All uneaten food will be sent to a compost facility so that emission of methane from the uneaten food will be largely reduced and the compost generated can nourish soil for healthier plants and gardens.*

- *Please do not share your food with others*

- *Please help us by leaving all leftovers from your meal on your tray. Return the tray to the survey table once you have finished the meal.*

Figure A1: Timeline of an experimental session

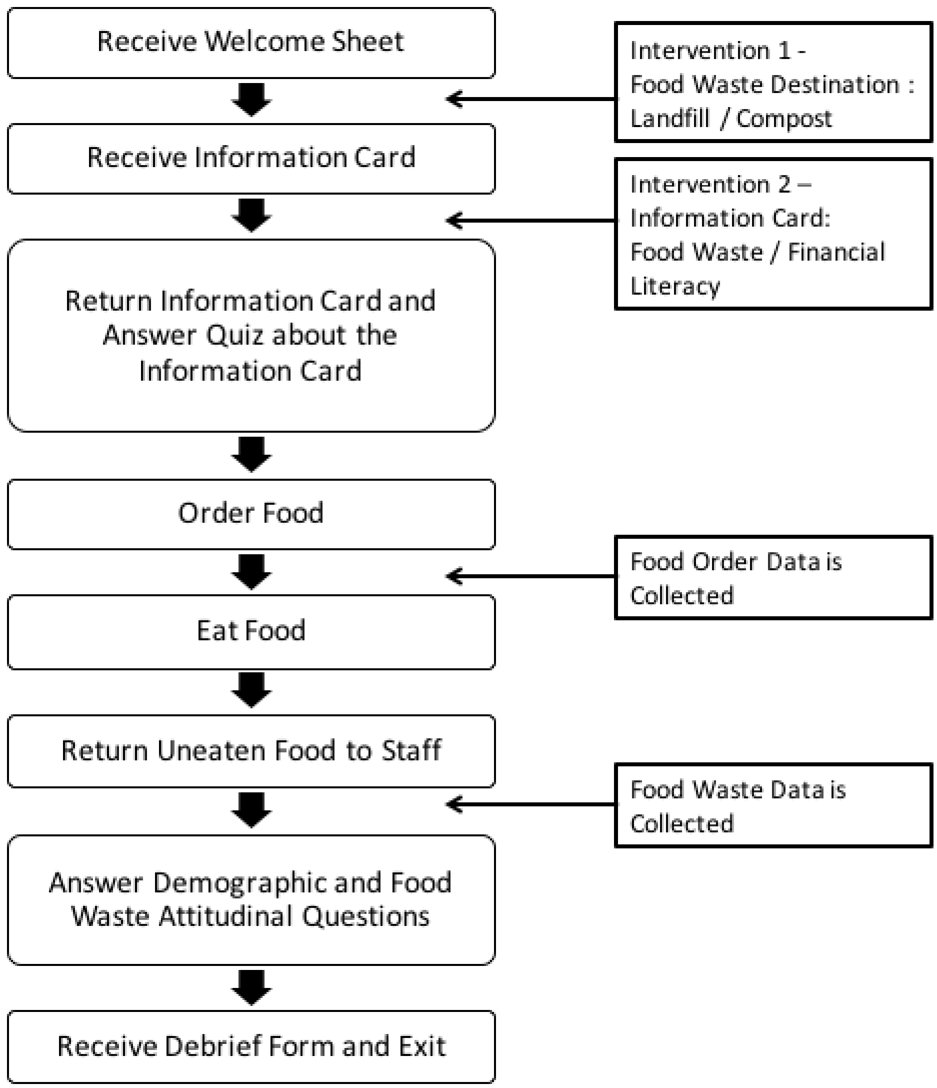


Figure A2. Food waste information card

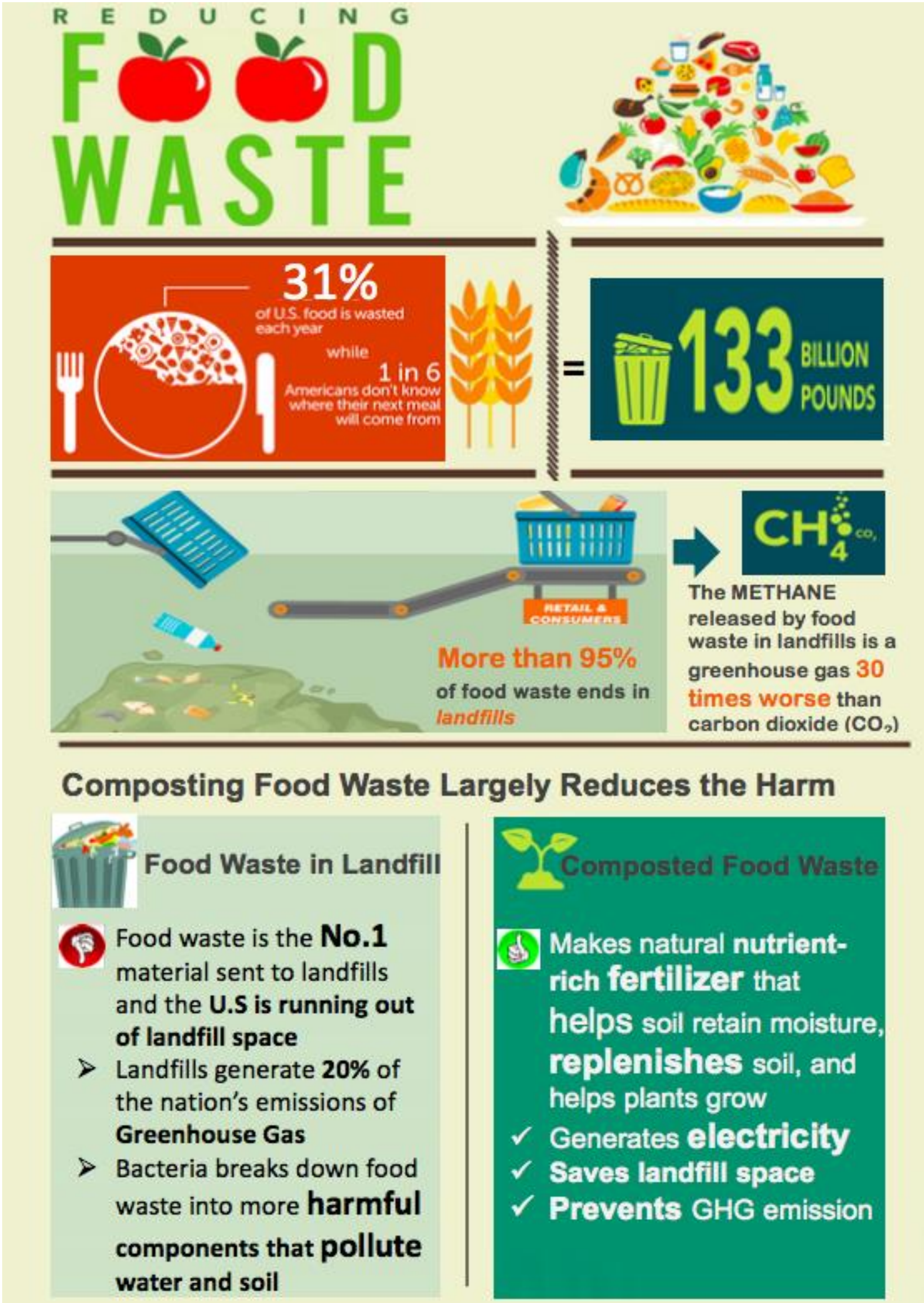
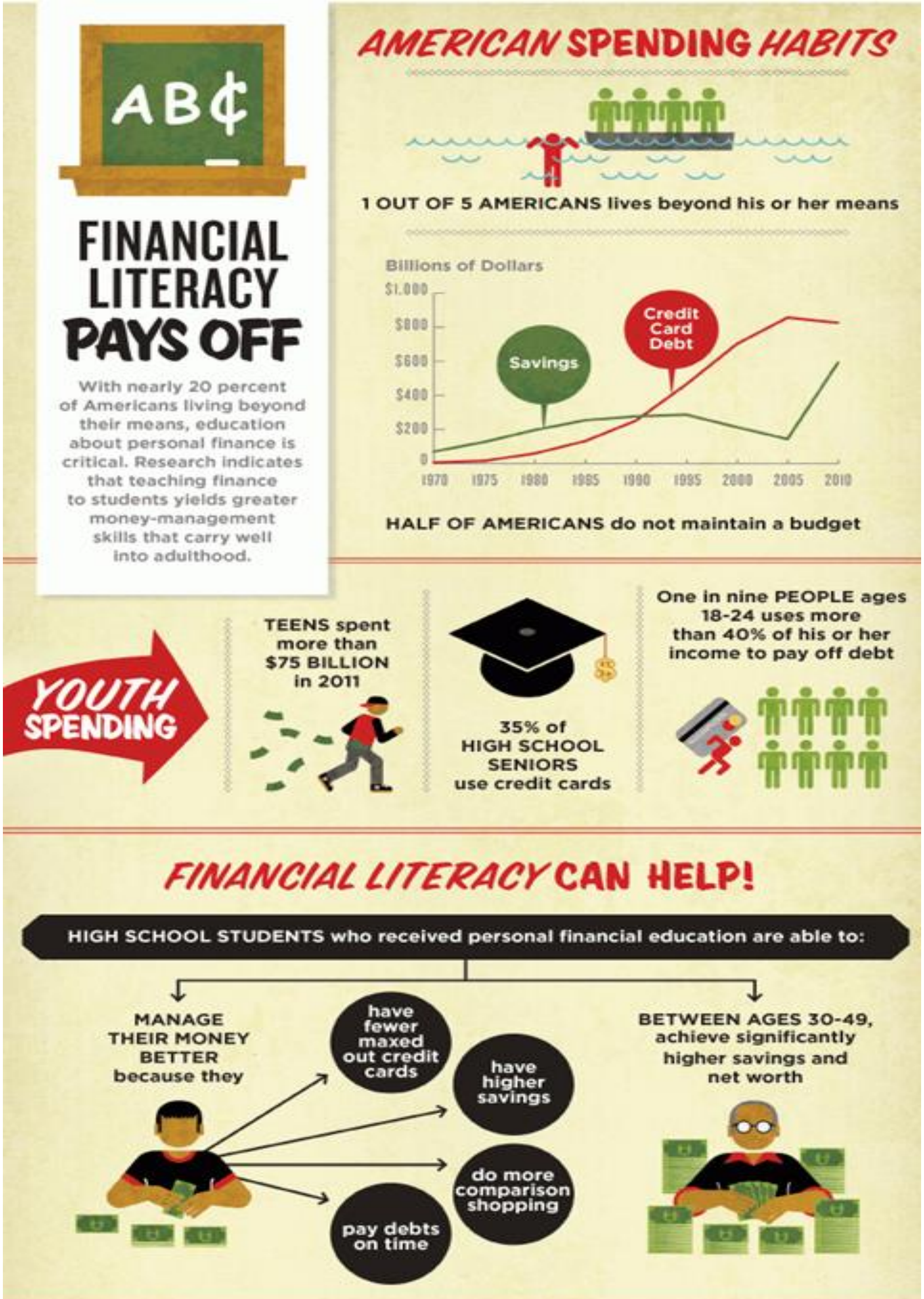


Figure A3: Financial literacy information card



Quiz for *FW* and *FW x Comp* groups

Q1. How much food was left uneaten at the retail and consumer level in U.S. in 2010?
1. 5% of overall food supply (=21 billion pounds)
2. 11% of overall food supply (=47 billion pounds)
3. 31% of overall food supply (=133 billion pounds)
4. 61% of overall food supply (=262 billion pounds)

Q2. Food waste in landfill will generate_____.
1. Carbon Dioxide (CO_2)
2. Methane (CH_4)
3. Nitrous Oxide (N_2O)
4. None of these

Q3. How do methane and carbon dioxide compare in term of greenhouse gas?
1. Methane (CH_4) is more powerful than carbon dioxide (CO_2)
2. Carbon dioxide (CO_2) is more powerful than Methane (CH_4)
3. They are about the same

Q4. Based on the information card, how does the damage from food waste in landfills compare to food waste sent to compost facilities?
1. Much less environmental damage from food waste in landfills vs composting
2. Somewhat less environmental damage from food waste in landfills vs composting
3. About the same
4. Somewhat more environmental damage from food waste in landfills vs composting
5. Much more environmental damage from food waste in landfills vs composting
6. Don't Know

Q5. Are you allowed to take any uneaten food away from this lunch?
1. Yes
2. No
3. Don't know

Q6[*FW*]. Where will the uneaten food from today's lunch be placed in?
1. Local facility, whose contents are placed in landfills
2. Organics disposal company
3. Don't know

Q6[*FW x Comp*]. Where will the uneaten food from today's lunch be placed in?
1. In a local facility, whose contents are placed in landfills
2. Composted to reduce the emission of methane and nourish soil
3. Don't know

Quiz for *Base* and *Comp* Groups

Q1. How many Americans lives beyond his or her means？
1. 1 out of 3
2. 1 out of 5
3. 1 out of 10
4. 1 out of 20

Q2 How many Americans DO NOT maintain a budget?
1. One third of Americans
2. Half of Americans
3. 3 out of 4 Americans

Q3. Which of the following is true about American youth spending?
1. Teens spent more than $75 billion in 2011
2. 35% of high school seniors use credit cards
3. One in nine people ages 18-24 uses more than 40% of his or her income to pay off debt
4. All of above

Q4. Which of the following is the solution provided by the information card?
1. Forbidding high school seniors using credit cards
2. Discourage teens from shopping alone
3. Teaching finance to high school students
4. None of them

Q5. How could financial literacy change high school students' financial behavior?
1. Have fewer maxed out credit cards
2. Have higher savings
3. Do more comparison shopping
4. Pay debts on time
5. All of the above

Q6. Are you allowed to take any uneaten food away from this lunch?
1. Yes
2. No
3. Don't know
4.

Q7[*Base*]. Where will the uneaten food from today's lunch be placed?
1. In a local facility, whose contents are placed in landfills
2. Organics disposal company
3. Don't know

Q7[*Comp*]. Where will the uneaten food from today's lunch be placed?
4. In a local facility, whose contents are placed in landfills
5. Organics disposal company
6. Don't know

Questionnaire

Food handling

Q1. How responsible are you for the food shopping and meal preparation in your home?
1. Mostly responsible
2. Somewhat responsible
3. Not at all responsible

Q2 [*Base* & *Comp*] In the last 12 months, have you read, seen or heard anything about the amount of food that is wasted or about ways to reduce the amount of food that is wasted?
1. Yes
2. No
3. Uncertain

Q3 [*Base* & *Comp*] Do you think there is much less, somewhat less, about the same, somewhat more or much more damage to the environment from food waste in landfills than from the composted food waste?
1. Much less environmental damage from food waste in landfills vs composting
2. Somewhat less
3. About the same
4. Somewhat more environmental damage from food waste in landfills vs composting
5. Much more
6. Don't Know

Q2[*FW* & *FW x Comp*]. Before today's session, but in the last 12 months, have you read, seen or heard anything about the amount of food that is wasted or about ways to reduce the amount of food that is wasted?
1. Yes
2. No
3. Uncertain

Q3[*FW* & *FW x Comp*]. Before today's session, do you think there is much less, somewhat less, about the same, somewhat more or much more damage to the environment from food waste in landfills than from the composted food waste?
1. Much less environmental damage from food waste in landfills vs composting
2. Somewhat less
3. About the same
4. Somewhat more environmental damage from food waste in landfills vs composting
5. Much more
6. Don't Know

Q4. To what extent would you agree with the following statements about food that is served in your home that gets thrown away?

A. Throwing away food is bad for the environment

1. Agree strongly
2. Agree somewhat
3. Disagree somewhat
4. Disagree strongly
5. Don't Know

B. Throwing away food is a major source of wasted money in your household
1. Agree strongly
2. Agree somewhat
3. Disagree somewhat
4. Disagree strongly
5. Don't Know

C. Throwing away food if the package date has passed reduces the chance someone will get sick from eating the food
1. Agree strongly
2. Agree somewhat
3. Disagree somewhat
4. Disagree strongly
5. Don't Know

D. You feel guilty when you throw away food
1. Agree strongly
2. Agree somewhat
3. Disagree somewhat
4. Disagree strongly
5. Don't Know

E. You don't have enough time to worry about the amount of food you throw away.
1. Agree strongly
2. Agree somewhat
3. Disagree somewhat
4. Disagree strongly
5. Don't Know

F. Sometimes it is necessary to throw away some food to make sure meals taste fresh and good
1. Agree strongly
2. Agree somewhat
3. Disagree somewhat
4. Disagree strongly
5. Don't Know

G. It would be difficult to reduce further the amount of food your household throws away
1. Agree strongly
2. Agree somewhat
3. Disagree somewhat

4. Disagree strongly
5. Don't Know

H. You throw away more food when you buy things in large packages or when you buy in large quantities during a sale
1. Agree strongly
2. Agree somewhat
3. Disagree somewhat
4. Disagree strongly
5. Don't Know

I. Your household throws away more food than other households of your size
1. Agree strongly
2. Agree somewhat
3. Disagree somewhat
4. Disagree strongly
5. Don't Know

J. You left more food uneaten than other people eating lunch here today
1. Agree strongly
2. Agree somewhat
3. Disagree somewhat
4. Disagree strongly
5. Don't Know

Q5. Did you give any food to others during today's lunch?
1. Yes
2. No

Q6. Did you take any food from others during today's lunch?
1. Yes
2. No

Q7. Before starting this questionnaire, what do you think was the purpose of this study?
1. Eating habit
2. Nutrition study
3. Consumption habit
4. Food handling habit
5. Food waste habit
6. Didn’t think about it
7. Other ____________________

Q8. Where will any food left over from your meal today be placed?
7. In a local facility, whose contents are placed in landfills
8. In an organics disposal company
9. It will be composted to reduce the emission of methane and nourish soil
10. Don’t know

Demographic Information

Q9. What is your age (in years)?

______ years

Q10. What is your sex?
1. Male
2. Female

Q11. Ethnicity origin (or Race): Please specify your ethnicity
1. White Non-Hispanic
2. Black Non-Hispanic
3. White Hispanic
4. Black Hispanic
5. Unspecified Hispanic
6. Asian/ Chinese/ Japanese
7. Native American/Alaska Native/Native Hawaiian/Pacific Islander
8. Other Race
9. Multiple Racial Identification

Q12. Marital Status: What is your marital status?
1. Single, never married
2. Married
3. Widowed
4. Divorced
5. Separated

Q13. Education: What is the highest degree or level of school you have completed? If currently enrolled, which year are you in?

1. Less than high school graduate
2. High school graduate
3. Some college
4. College graduate
5. Graduate or Professional school
6. (Currently enrolled) Undergraduate 1st year
7. (Currently enrolled) Undergraduate 2nd Year
8. (Currently enrolled) Undergraduate 3rd Year
9. (Currently enrolled) Undergraduate 4th Year
10. (Currently enrolled) Graduate or Professional Students

Q14. Employment: Are you currently…?
1. Full-time
2. Part-time
3. Retired
4. Homemaker
5. Student
6. Temporarily unemployed
7. Disabled/handicapped
8. Other not employed

Q15. Including yourself, how many people live in your households?
____

Q16. How many of these are children under the age of eighteen years?
____

Q17. How many of these adults are female?
____

Q18. Which state/country did you grow up in?
____

Q19. Which of the following best describes your metro status of the place where you grew up?
1. In a city
2. In an inner suburb
3. In an outer suburb
4. In a rural area
5. In another setting _______________________

Q20. Which of the following best describes your current residential setting? I live…
1. On campus
2. In a city
3. In an inner suburb
4. In an outer suburb
5. In a rural area

6. In another setting ________________________

Q21. Is your home owned or rented?
1. Owned
2. Rented

Q22. Do you have health insurance?
1. Yes
2. No
3. Don’t know

Q23. What was your total household income before taxes during the past 12 months?
1. Less than $50,000
2. $50,000-$99,999
3. More than $100,000

Q24. When it comes to recycling cans, bottles and paper, which best describes your level of activity? I recycle…
1. Whenever possible
2. Most of the time
3. Occasionally
4. Seldom
5. Never

Q25. Have you ever lived in a household where uneaten food was composted?
1. Yes
2. No
3. Unsure

Table A1. Marginal Treatment Effects on the Level of Solid Food Waste
Dependent Variable = Grams of solid food waste

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-31.249***	-30.919***	-43.623***
	(3.862)	(11.284)	(7.328)
Comp	-6.747	-5.188	
	(5.012)	(6.374)	
FW x Comp	25.822**	24.698	
	(9.384)	(15.011)	
Compliance			
E[Comp]			-7.572
			(5.625)
FW x E[Comp]			39.637***
			(13.612)
Observations	237	237	236
R-squared	0.295		0.272

Robust standard errors clustered at the session level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table A2. Marginal Treatment Effects on the Solid Food Order

VARIABLES	OLS Log(order-solid+1)	OLS Order-solid
Group Assignment		
FW	-0.034	-62.781
	(0.059)	(69.603)
Comp	0.046	41.497
	(0.033)	(46.045)
FW x Comp	0.006	11.972
	(0.050)	(57.078)
Constant	7.072***	1,268.083***
	(0.167)	(204.653)
Observations	237	237
R-squared	0.357	0.354

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A3. Marginal Treatment Effects on the Level of Sandwich Waste
Dependent Variable = Grams of sandwich waste

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-21.270***	-42.531***	-30.979***
	(4.192)	(8.024)	(7.089)
Comp	-5.839	-8.831	
	(4.764)	(8.571)	
FW x Comp	19.650**	36.758***	
	(8.365)	(12.216)	
Compliance			
E[*Comp*]			-7.299
			(5.523)
FW x E[Comp]			30.861***
			(11.818)
Observations	237	237	236
R-squared	0.303		0.279

Robust standard errors clustered at the session level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table A4. Marginal Treatment Effects on the Log of Sandwich Waste
Dependent Variable = Log (grams of sandwich waste+1)

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-1.309***	-1.730*	-1.882***
	(0.363)	(0. 897)	(0.520)
Comp	-0.207	-0. 224	
	(0.328)	(0. 324)	
FW x Comp	1.123*	1.454*	
	(0.516)	(0. 754)	
Compliance			
E[Comp]			-0.238
			(0.379)
FW x E[Comp]			1.763**
			(0.722)
Observations	237	237	236
R-squared	0.275		0.250

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A5. Marginal Treatment Effects on the Sandwich Waste
Dependent Variable = 1(grams of sandwich waste>0)

VARIABLES	LPM	Probit	LPM-IV
Group Assignment			
FW	-0.273*	-0.265**	-0.415***
	(0.130)	(0. 115)	(0.158)
Comp	-0.058	-0.056	
	(0.072)	(0. 063)	
FW x Comp	0.261*	0. 252**	
	(0.130)	(0. 115)	
Compliance			
E[Comp]			-0.076
			(0.084)
FW x E[Comp]			0.415**
			(0.170)
Observations	237	237	236
R-squared	0.238		0.200

Robust standard errors clustered at the session level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table A6. Marginal Treatment Effects on the Sandwich Order

VARIABLES	OLS Log(order-sub+1)	OLS Order-sub
Group Assignment		
FW	-0.031	-56.301
	(0.066)	(70.812)
Comp	0.046	33.917
	(0.035)	(44.918)
FW x Comp	0.018	25.432
	(0.052)	(55.630)
Constant	6.937***	1,127.394***
	(0.180)	(198.674)
Observations	237	237
R-squared	0.347	0.350

Robust standard errors clustered at the session level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A7. Marginal Treatment Effects on the Level of Apple Waste
Dependent Variable = Grams of apple waste

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-9.016**	-59.220***	-11.736***
	(3.957)	(14.405)	(4.040)
Comp	-4.454	-20.042	
	(5.906)	(20.752)	
FW x Comp	9.396	63.059***	
	(6.449)	(24.151)	
Compliance			
E[Comp]			-4.250
			(6.112)
FW x E[Comp]			11.749
			(7.323)
Observations	237	237	236
R-squared	0.192		0.182

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A8. Marginal Treatment Effects on the Log of Apple Waste
Dependent Variable = Log (grams of apple waste + 1)

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-0.695**	-1.418	-1.011***
	(0.314)	(1.683)	(0.333)
Comp	-0.241	-0.371	
	(0.390)	(0.570)	
FW x Comp	0.772*	1.528	
	(0.425)	(1.928)	
Compliance			
E[Comp]			-0.251
			(0.407)
FW x E[Comp]			1.104**
			(0.491)
Observations	237	237	236
R-squared	0.196		0.189

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A9. Marginal Treatment Effects on the Apple Waste
Dependent Variable = 1(grams of apple waste>0)

VARIABLES	LPM	Probit	LPM-IV
Group Assignment			
FW	-0.191**	-0.258***	-0.291***
	(0.087)	(0.074)	(0.095)
Comp	-0.056	-0 .083	
	(0.099)	(0.217)	
FW x Comp	0.228*	0.331***	
	(0.111)	(0.079)	
Compliance			
E(comp)			-0.056
			(0.104)
FW x E[Comp]			0.335**
			(0.132)
Observations	237	230	236
R-squared	0.196		0.192

Robust standard errors clustered at the session level in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table A10. Marginal Treatment Effects on the Apple Order

VARIABLES	OLS Log(order-apple+1)	OLS Order-apple
Group Assignment		
FW	-0.229	-3.509
	(0.222)	(4.337)
Comp	0.295	10.136*
	(0.169)	(4.722)
FW x Comp	-0.435	-14.215
	(0.369)	(8.304)
Constant	5.209***	128.343***
	(0.809)	(21.276)
Observations	237	237
R-squared	0.141	0.161

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A11. Marginal Treatment Effects on the Level of chip Waste
Dependent Variable = Grams of chip waste

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-0.963	-7.885	-0.908
	(0.763)	(8.057)	(1.014)
Comp	3.546*	11.839	
	(1.635)	(8.301)	
FW x Comp	-3.224	-3.484	
	(2.351)	(10.547)	
Compliance			
E[Comp]			3.978**
			(1.880)
FW x E[Comp]			-2.973
			(2.713)
Observations	237	237	236
R-squared	0.115		0.108

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A12. Marginal Treatment Effects on the Log of Chip Waste

Dependent Variable = Log (grams of chip waste+1)

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-0.131	-0.106	-0.257*
	(0.128)	(0. 257)	(0.142)
Comp	0.155**	0.130	
	(0.064)	(0.252)	
FW x Comp	0.023	-0.018	
	(0.139)	(0.160)	
Compliance			
E[Comp]			0.143*
			(0.085)
FW x E[Comp]			0.200
			(0.174)
Observations	237	237	236
R-squared	0.230		0.229

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A13. Marginal Treatment Effects on the Chip Waste
Dependent Variable = 1(grams of chip waste>0)

VARIABLES	LPM	Probit	LPM-IV
Group Assignment			
FW	-0.077	-0.046	-0.148***
	(0.047)	(0. 044)	(0.050)
Comp	0.034	0. 079**	
	(0.027)	(0.035)	
FW x Comp	0.074	0. 006	
	(0.052)	(0.045)	
Compliance			
E[Comp]			0.025
			(0.036)
FW x E[Comp]			0.165**
			(0.070)
Observations	237	199	236
R-squared	0.286		0.290

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A14. Marginal Treatment Effects on the Chip Order

	OLS	OLS
VARIABLES	Log(order-chip+1)	Order-chip
Group Assignment		
FW	-0.221	-2.971
	(0.247)	(3.056)
Comp	-0.195	-2.556
	(0.281)	(3.152)
FW x Comp	-0.020	0.755
	(0.386)	(3.948)
Constant	1.545***	12.346**
	(0.498)	(4.168)
Observations	237	237
R-squared	0.167	0.166

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A15. Marginal Treatment Effects on the Level of Beverage Waste
Dependent Variable = Grams of Beverage waste

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-36.474***	-44.481**	-42.927***
	(11.343)	(17.350)	(15.416)
Comp	-27.199***	-37.653***	
	(8.014)	(12.606)	
FW x Comp	23.558	33.488**	
	(13.871)	(15.315)	
Compliance			
E[Comp]			-33.852***
			(7.609)
FW x E[Comp]			31.469*
			(18.149)
Observations	237	237	236
R-squared	0.308		0.302

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A16. Marginal Treatment Effects on the Log of Beverage Waste
Dependent Variable = Log (grams of beverage waste+1)

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-1.562***	-1.441*	-1.963***
	(0.317)	(0. 818)	(0.422)
Comp	-1.351***	-1.330*	
	(0.236)	(0. 700)	
FW x Comp	1.558***	1.477*	
	(0.358)	(0. 849)	
Compliance			
E[Comp]			-1.636***
			(0.228)
FW x E[Comp]			2.000***
			(0.477)
Observations	237	237	236
R-squared	0.376		0.365

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A17. Marginal Treatment Effects on the Beverage Waste
Dependent Variable = 1(grams of beverage waste>0)

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-0.348***	-0.339***	-0.426***
	(0.076)	(0. 052)	(0.105)
Comp	-0.291***	-0.305***	
	(0.053)	(0. 036)	
FW x Comp	0.348***	0.363***	
	(0.089)	(0. 074)	
Compliance			
E[Comp]			-0.344***
			(0.061)
FW x E[Comp]			0.427***
			(0.120)
Observations	237	237	236
R-squared	0.402		0.388

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A18. Marginal Treatment Effects on the Beverage Order

	OLS	OLS
VARIABLES	Log(order-beverage+1)	Order-beverage
Group Assignment		
FW	-0.201	-30.599*
	(0.239)	(15.646)
Comp	-0.246	-15.028
	(0.206)	(13.726)
FW x Comp	0.217	33.108
	(0.309)	(22.528)
Constant	4.792***	288.803***
	(0.750)	(59.835)
Observations	237	237
R-squared	0.150	0.186

Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A19: Marginal Treatment Effects on Solid Food Waste

Dependent Variable = Log (grams of solid food waste + 1)

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
FW	-1.503***	-1.980***	-2.137***
	(0.312)	(0.448)	(0.504)
Comp	-0.275	-0.265	
	(0.333)	(0.449)	
FW x Comp	1.299**	1.689**	
	(0.560)	(0.760)	
Compliance			
E[Comp]			-0.306
			(0.376)
FW x E[Comp]			2.000**
			(0.777)
Order			
Apple	0.188	0.450	0.236
	(0.275)	(0.378)	(0.225)
Chip	0.024	0.142	-0.059
	(0.171)	(0.197)	(0.155)
Sandwich	0.047	0.087	0.052
	(0.057)	(0.079)	(0.054)
Beverage	0.302	0.715	0.152
	(0.471)	(0.525)	(0.452)
Water	0.371	0.940*	0.163
	(0.515)	(0.529)	(0.470)
Responsibility for Food Preparation			
Somewhat	-0.144	-0.336	-0.074
	(0.366)	(0.504)	(0.338)
Not at all	0.093	0.383	0.366
	(0.607)	(0.761)	(0.463)
Awareness about Food Waste			
Unaware	0.054	0.091	0.065
	(0.217)	(0.291)	(0.223)
Uncertain	-0.864**	-1.111***	-0.859**
	(0.350)	(0.417)	(0.373)

Perceived Environmental Damage from Food Waste in Landfill Compared to Composted Food Waste (before the study			
Somewhat less	-1.890**	-1.459	-1.863**
	(0.822)	(1.168)	(0.749)
About the same	-1.169*	-0.698	-0.901*
	(0.611)	(0.763)	(0.466)
Somewhat more	-1.174*	-0.592	-1.016*
	(0.652)	(0.787)	(0.533)
Much more	-1.462**	-1.029	-1.152**
	(0.615)	(0.815)	(0.567)
Don't Know	-0.934*	-0.378	-0.616
	(0.506)	(0.842)	(0.413)
Awareness about the Study Purpose			
Food Waste	0.117	0.132	0.136
	(0.156)	(0.226)	(0.141)
Age	-0.009	-0.004	-0.010
	(0.010)	(0.010)	(0.007)
Male	-0.754**	-1.114**	-0.820**
	(0.344)	(0.481)	(0.322)
Race			
Black	0.186	0.709**	-0.077
	(0.215)	(0.332)	(0.175)
Asian	-0.429	-0.304	-0.705**
	(0.437)	(0.451)	(0.328)
Other	-0.066	-0.018	-0.082
	(0.414)	(0.504)	(0.330)
Education			
College graduate	0.230	0.190	0.170
	(0.357)	(0.337)	(0.394)
Graduate degree	0.128	0.374	-0.000
	(0.412)	(0.330)	(0.377)
Current Undergrad	-0.079	-0.021	-0.188
	(0.468)	(0.327)	(0.413)
Current Grads	-0.538	-0.552	-0.621
	(0.648)	(0.686)	(0.605)
Employment			
Part-time	-0.388	-0.501	-0.153
	(0.474)	(0.630)	(0.477)
Student	0.000	-0.046	0.045
	(0.321)	(0.279)	(0.285)
Other	0.329	0.552	0.301

	(0.473)	(0.672)	(0.398)
Metro Status: grew up			
Inner Suburb	-0.173	0.273	-0.160
	(0.530)	(0.468)	(0.471)
Outer Suburb	-0.348	-0.055	-0.503*
	(0.344)	(0.329)	(0.304)
Rural Area	-0.939**	-0.653**	-1.145***
	(0.312)	(0.273)	(0.272)
Metro Status: Residence			
City	0.014	0.162	-0.120
	(0.344)	(0.321)	(0.293)
Inner Suburb	-0.260	-0.309	-0.445
	(0.367)	(0.518)	(0.317)
Outer Suburb	0.120	0.253	-0.070
	(0.443)	(0.297)	(0.351)
Rural Area	-0.200	-0.032	-0.251
	(0.503)	(0.467)	(0.412)
Recycle			
Most of the time	-0.342	-0.268	-0.291
	(0.330)	(0.372)	(0.279)
Occasionally	0.571	0.737	0.562
	(0.393)	(0.638)	(0.351)
Seldom	0.400	0.637	0.560
	(0.545)	(0.752)	(0.424)
Observations	237	237	236
R-squared	0.297		0.288

Robust standard errors clustered at the session level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A20: Marginal Treatment Effects on Solid Food Waste

Dependent Variable = 1 if Solid Food Waste > 0; = 0 otherwise

VARIABLES	LPM	Probit	LPM-IV
Group Assignment			
FW	-0.275**	-0.917***	-0.393***
	(0.105)	(0.321)	(0.135)
Comp	-0.074	-0.336*	
	(0.059)	(0.202)	
FW x Comp	0.291*	1.046***	
	(0.135)	(0.393)	
Compliance			
E[Comp]			-0.077
			(0.066)
FW x E[Comp]			0.412**
			(0.172)
Order			
Apple	0.008	0.023	0.021
	(0.085)	(0.242)	(0.071)
Chip	0.031	0.136	0.012
	(0.053)	(0.161)	(0.048)
Sandwich	0.005	0.010	0.007
	(0.016)	(0.049)	(0.015)
Beverage	0.121	0.464	0.092
	(0.120)	(0.404)	(0.118)
Water	0.229	0.836**	0.185
	(0.136)	(0.410)	(0.126)
Responsibility for Food Preparation			
Somewhat	-0.039	-0.130	-0.023
	(0.084)	(0.238)	(0.079)
Not at all	0.244	1.061	0.304***
	(0.160)	(0.667)	(0.112)
Awareness about Food Waste			
Unaware	0.008	0.009	0.014
	(0.059)	(0.190)	(0.053)
Uncertain	-0.100	-0.373	-0.094
	(0.083)	(0.248)	(0.090)

Perceived Environmental Damage from Food Waste in Landfill Compared to Composted Food Waste (before the study			
Somewhat less	-0.382*	-1.169*	-0.397**
	(0.208)	(0.678)	(0.174)
About the same	-0.246	-0.727	-0.188
	(0.151)	(0.529)	(0.118)
Somewhat more	-0.222	-0.726	-0.190
	(0.180)	(0.640)	(0.151)
Much more	-0.241	-0.715	-0.177
	(0.167)	(0.612)	(0.152)
Don't know	-0.151	-0.223	-0.086
	(0.142)	(0.502)	(0.113)
Awareness about the Study Purpose			
Food Waste	-0.004	-0.054	-0.004
	(0.053)	(0.190)	(0.047)
Age	-0.002	-0.006	-0.002
	(0.003)	(0.010)	(0.003)
Male	-0.180	-0.543*	-0.201**
	(0.103)	(0.310)	(0.093)
Race			
Black	0.115	0.440	0.062
	(0.094)	(0.327)	(0.081)
Asian	-0.166	-0.538	-0.222***
	(0.104)	(0.362)	(0.081)
Other	-0.066	-0.200	-0.067
Education	(0.126)	(0.381)	(0.106)
College graduate	0.024	0.128	0.012
	(0.113)	(0.387)	(0.118)
Graduate degree	0.080	0.273	0.049
	(0.111)	(0.393)	(0.103)
Current Undergrad	0.032	0.005	0.007
	(0.144)	(0.495)	(0.129)
Current Grads	-0.106	-0.348	-0.126
Employment	(0.190)	(0.602)	(0.171)
Part-time	-0.065	-0.282	-0.019
	(0.128)	(0.393)	(0.127)
Student	0.107	0.201	0.107
	(0.162)	(0.625)	(0.133)
Other	-0.029	-0.150	-0.015

Metro Status: grew up	(0.068)	(0.219)	(0.051)
Inner Suburb	0.016	0.073	0.022
	(0.121)	(0.466)	(0.109)
Outer Suburb	-0.068	-0.272	-0.097
	(0.103)	(0.320)	(0.087)
Rural Area	-0.206*	-0.722**	-0.251**
Metro Status: Residence	(0.110)	(0.368)	(0.100)
City	-0.011	-0.054	-0.038
	(0.062)	(0.176)	(0.048)
Inner Suburb	-0.144	-0.536	-0.187**
	(0.101)	(0.334)	(0.086)
Outer Suburb	-0.060	-0.289	-0.098
	(0.114)	(0.362)	(0.086)
Rural Area	-0.091	-0.427	-0.103
Recycle	(0.127)	(0.333)	(0.113)
Most of the time	-0.029	-0.096	-0.016
	(0.081)	(0.235)	(0.068)
Occasionally	0.203*	0.818**	0.203**
	(0.096)	(0.396)	(0.087)
Seldom	0.176	0.652	0.212*
	(0.154)	(0.514)	(0.127)
Constant	0.949***	1.495*	1.002***
	(0.258)	(0.847)	(0.236)
Observations	237	237	236
R-squared	0.256		0.252

Robust standard errors clustered at the session level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A21: Regression Results from the First stage of 3SLS

Dependent Variable = E[*Comp*]

VARIABLES	Probit Model E[*Comp*]
Group Assignment	
FW	0.483**
	(0.211)
Comp	2.640***
	(0.324)
FW x Comp	-0.281
	(0.414)
Responsibility for Food Preparation	
Somewhat	-0.034
	(0.200)
Not at all	0.695
	(0.551)
Awareness about Food Waste (before the study)	
Unaware	0.180
	(0.397)
Uncertain	-0.226
	(0.462)
Perceived Environmental Damage from Food Waste in Landfill Compared to Composted Food Waste (before the study)	
Somewhat less	0.018
	(0.856)
About the same	0.052
	(0.949)
Somewhat more	-0.455
	(0.709)
More	-0.522
	(0.823)
Don't know	-0.519
	(0.929)
Constant	-0.701
	(0.684)
Observations	248

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table A22: Regression Results from the Second stage of 3SLS

VARIABLES	OLS E[*Comp*]	OLS FW x E[*Comp*]
Predicted E[Comp]	1.011***	
	(0.066)	
FW x Predicted E[Comp]		0.923***
		(0.095)
Group Assignment		
FW	-0.008	0.067
	(0.042)	(0.081)
Order		
Apple	-0.074	-0.020
	(0.055)	(0.044)
Chip	0.039	0.034
	(0.043)	(0.032)
Sandwich	-0.012	-0.000
	(0.009)	(0.006)
Beverage	0.108	0.086
	(0.077)	(0.064)
Water	0.115	0.090
	(0.069)	(0.053)
Responsibility for Food Preparation		
Somewhat	-0.033	-0.018
	(0.041)	(0.028)
Not at all	0.075	-0.157
	(0.192)	(0.135)
Awareness about Food Waste (before the study)		
Unaware	0.008	-0.005
	(0.066)	(0.057)
Uncertain	0.011	0.045
Perceived Environmental Damage from Food Waste in Landfill Compared to Composted Food Waste (before the study)	(0.093)	(0.084)
Somewhat less	0.054	-0.138
	(0.233)	(0.123)
About the same	-0.007	-0.120
	(0.232)	(0.111)

Somewhat more	0.043	-0.045
	(0.211)	(0.083)
More	0.044	-0.098
	(0.214)	(0.091)
Don't know	0.008	-0.127
	(0.229)	(0.090)
Awareness about the Study Purpose		
Food Waste	-0.053	-0.032
	(0.044)	(0.029)
Age	0.002	0.001
	(0.002)	(0.002)
Male	-0.038	-0.003
	(0.059)	(0.038)
Race		
Black	0.178**	0.155***
	(0.069)	(0.049)
Asian	0.175*	0.169**
	(0.089)	(0.076)
Other	0.189*	0.067
	(0.104)	(0.064)
Education		
College graduate	-0.042	0.031
	(0.128)	(0.105)
Graduate degree	0.007	0.033
	(0.125)	(0.099)
Current Undergrad	-0.020	0.039
	(0.080)	(0.060)
Current Grads	-0.021	0.012
	(0.113)	(0.094)
Employment		
Part-time	-0.175**	-0.131**
	(0.063)	(0.053)
Student	-0.081	0.023
	(0.102)	(0.056)
Other	-0.012	-0.007
	(0.066)	(0.047)
Metro Status: grew up		
Inner Suburb	-0.023	0.001
	(0.071)	(0.036)
Outer Suburb	0.043	0.097*
	(0.082)	(0.051)
Rural Area	0.076	0.091*
	(0.061)	(0.043)
Metro Status: Residence		
City	0.094	0.094

	(0.064)	(0.062)
Inner Suburb	0.082	0.078
	(0.071)	(0.053)
Outer Suburb	0.062	0.113
	(0.091)	(0.076)
Rural Area	0.016	0.040
	(0.109)	(0.108)
Recycle		
Most of the time	0.004	-0.013
	(0.068)	(0.057)
Occasionally	0.004	0.020
	(0.068)	(0.053)
Seldom	0.161	-0.037
	(0.118)	(0.060)
Constant	-0.194	-0.213
	(0.187)	(0.125)
Observations	236	236
R-squared	0.650	0.794

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A23: Instrumental Variable Tests

Weak identification test (Cragg-Donald Wald F statistic)	75.95
(Kleibergen-Paap rk Wald F statistic)	46.42
Stock-Yogo weak ID test critical values: 10% maximal IV size	7.03
15% maximal IV size	4.58
20% maximal IV size	3.95
25% maximal IV size	3.63