



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

**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.

Copyright 2016 by Danyi Qi and Brian E. Roe. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

1
2 **Foodservice Composting Crowds Out**

3 **Consumer Food Waste Reduction Behavior in a Dining Experiment¹**

4 Danyi Qi, PhD Candidate
5 Department of Agricultural, Environmental and Development Economics
6 The Ohio State University
7 Email: qi.163@osu.edu
8

9
10 Brian E. Roe, Professor
11 Department of Agricultural, Environmental and Development Economics
12 The Ohio State University
13 Email: roe.30@osu.edu

14 Pressure mounts to address food waste, which deprives hungry people of needed nutrition, depletes
15 resources used to produce food, and accounts for substantial greenhouse gas emissions during
16 production, distribution and disposal. Composting, and other food waste recycling technologies
17 that divert food waste from landfills, mitigate the environmental damages of food waste disposal
18 and grow in popularity. We explore whether consumer knowledge that the environmental damage
19 created by their food waste will be mitigated undermines personal food waste reduction behavior.
20 Subjects in a dining situation are randomly assigned whether or not they receive information about
21 the negative effects of landfilling food waste and whether they are told that uneaten food from the
22 study will be composted or landfilled. We find that providing information about the negative
23 effects of food waste in landfills significantly reduces both the propensity to create any food waste
24 and the total amount of solid food waste created when compared to control subjects. However, if
25 subjects are also informed that food waste from the study will be composted, the propensity to
26 create food waste and the amount of solid food waste generated is similar to control situation which
27 features neither a reduction nor a recycling policy. This suggests a crowding out effect or
28 informational rebound effect in which promoting policies that mitigate the environmental damages
29 of food waste may unintentionally undermine policies meant to encourage individual consumer
30 food waste reduction. We discuss key policy implications as well as several limitations of our
31 experimental setting and analysis.
32

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

35 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.

36 Pressure mounts to address food waste, which deprives hungry people of needed nutrition, depletes
37 resources used to produce food, and causes greenhouse gas emissions during production,
38 distribution and disposal (Okawa, 2015, Parfitt, et al., 2010, Quested, et al., 2013, Quested, et al.,
39 2013, Secondi, et al., 2015). In response to the U.S. government’s announcement of a goal to cut
40 domestic food waste in half by 2030 (USDA, 2015), the private-public group Rethink Food Waste
41 through Economics and Data (ReFED) issued a synthesis report that articulates and assesses 27
42 strategies for addressing food waste (ReFED, 2016). One category of strategies – reduction
43 strategies – engage consumers and the institutions serving consumers (e.g., food service,
44 supermarkets) to reduce the amount of food wasted. Another category – recycling strategies –
45 engage consumers and the institutions serving consumers (e.g., food service and local governments)
46 to divert food scraps from landfills through technologies such as composting or anaerobic digestion.
47 ReFED (2016) argues that reduction strategies deliver the greatest potential net economic benefits
48 on a per-strategy basis while recycling strategies hold the greatest potential in terms of scalability
49 and the total volume of food waste potentially diverted from landfills.

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

59 cause negative interactions could guide strategic implementation to mitigate any undesirable
60 interactions.

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

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

82 measured and then modeled as a function of the randomly assigned information treatment with
83 controls for individual characteristics.

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

98 The results match the predictions from a formal model of consumer ordering and
99 consumption behavior that incorporates key facets of our dining study (food must be ordered in
100 discrete amounts, zero marginal cost of increasing order size, a single opportunity to order food,
101 no food may be taken away from the study). The results suggest that a possible avenue for
102 offsetting such rebound or crowd-out effects is for food service institutions to focus consumer
103 messaging on the benefits of reducing food waste while remaining silent to consumers about any
104 institutional food waste recycling efforts. Hence, institutions may want to reconsider ‘green

105 promotion' efforts targeted at consumers that highlight environmentally beneficial initiatives such
106 as food waste composting if such efforts may undermine consumer motivation to reduce waste.

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

115

116 **A Model of Consumer Food Ordering, Consumption and Waste**

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

125 The utility from food intake is $U(q_c)$ which features a classical shape that is increasing at
126 a decreasing rate until a saturation point at which marginal utility declines with additional food
127 intake (i.e., there is disutility from over-eating). The diner experiences disutility (e.g, a general

128 feeling of guilt) when food is wasted, which occurs when $q_t - q_c > 0$ in this ‘no doggie bag’
129 setting. $G(q_t - q_c)$ is the disutility of food waste, which is increasing with the total amount of
130 waste ($G'(\cdot) > 0$) and yields no disutility from zero waste ($G(0) = 0$). Disutility grows with a
131 diner’s awareness of food waste, $\lambda_{fw}G(q_t - q_c)$ where $\lambda_{fw} \in [0,1]$ represents the awareness
132 level. A fully aware diner ($\lambda_{fw} = 1$) experiences the full disutility $G(q_t - q_c)$ while a fully
133 unaware diner ($\lambda_{fw} = 0$) experiences no disutility.

134 At the same time, wasted food in landfills generates an extra environmental cost, $e(q_t -$
135 $q_c)$, which increases with the amount of waste $e'(\cdot) > 0$. This cost is mitigated by food waste
136 recycling policies such as composting. Hence the actual environmental cost is $f(\eta)e(q_t - q_c)$
137 where $\eta \in [0,1]$ is the composting rate and $f(\eta) \in [0,1]$ is the mitigation effect. For simplicity,
138 we assume that composting ($\eta = 1$) eliminates all the extra environmental costs ($f(1) = 0$), while
139 food waste remaining in a landfill ($\eta = 0$) will generate the full environmental cost $f(0) = 1$.
140 When $0 < \eta < 1$, part of the food waste is composted and the rest goes to a landfill. The
141 environmental cost from wasted food is reduced as the composting rate increases ($f'(\cdot) < 0$).

142 The diner internalizes the environmental cost based on his awareness of the environmental
143 externality from wasted food in the landfill and of his awareness of the differences between the
144 two waste management methods, composting and landfilling, ($\lambda_m \in [0,1]$). The internalized
145 environmental cost combines the actual cost and awareness level $\lambda_m f(\eta)e(q_t - q_c)$. The diner
146 who is unaware of the environmental externality from food waste in a landfill ($\lambda_m = 0$) doesn’t
147 internalize the extra cost and also doesn’t appreciate the benefits of composting. An aware diner
148 ($\lambda_m = 1$) fully internalizes the environmental costs of food waste destined for the landfill ($e(q_t -$
149 $q_c)$), and such costs are eliminated when food waste is composted.

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

151
$$U(q_c) - \lambda_{fw}G(q_t - q_c) - \lambda_m f(\eta)e(q_t - q_c).$$

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

154 (1)
$$U'(q_c) = 0.$$

155 Let $U'(q_c^*) = 0$, hence q_c^* is the unconstrained maximizer of $U(q_c)$ of the unaware diner in this
 156 no-storage situation. Within the context of the experiment, diners can only order items in discrete
 157 units (4 inch segments of sandwich and fixed-size bags of chips and apples). Hence, rather than
 158 choosing food quantity from a continuous interval, the diner must choose quantities from a discrete
 159 set, $q_t \in [0, q_t^1, q_t^2, \dots, q_t^n]$. Assume the choice set does not contain the optimal amount, i.e., $q_c^* \notin$
 160 $[0, q_t^1, q_t^2, \dots, q_t^n]$. Define $q_c^{min} < q_c^* < q_c^{max}$ as the quantities from the choice set that surround
 161 optimal consumption.¹ When wasting food is costless ($\lambda_{fw} = \lambda_m = 0$), the diner over-orders, i.e.,
 162 $q_t = q_c^{max} > q_c^*$, eats q_c^* , and wastes the rest ($q_c^{max} - q_c^*$).

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

166 (2)
$$U(q_{c_under}^*) = U(q_c^{min}) < U(q_c^*).$$

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

169 (3)
$$U(q_{c_over}) - \lambda_{fw}G(q_c^{max} - q_{c_over}) - \lambda_m f(\eta)e(q_c^{max} - q_{c_over}) < U(q_c^*).$$

170 To maximize utility,

171 (4)
$$U'(q_{c_over}^*) = -\lambda_{fw}G'(q_c^{max} - q_{c_over}^*) - \lambda_m f(\eta)e'(q_c^{max} - q_{c_over}^*) < 0.$$

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

175 (5)
$$\frac{\partial U'(q_c)}{\partial \eta} = -\lambda_{fw} f'(\eta) e'(q_c^{max} - q_c) > 0.$$

176
 177 Proposition 1: *When the diner perceives wasting food to be costly and the optimal intake level*
 178 *is unavailable when ordering ($q_t \neq q_c^*$), the diner will reduce food waste either by under-*
 179 *ordering and under-eating or by over-ordering and over-eating. However, such an effort is*
 180 *discouraged when the diner becomes aware of composting. Awareness of a higher composting*
 181 *rate encourages over-ordering and results in more food waste when food is over-ordered,*
 182 *which yields a crowding-out/rebound effect.*

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

185 (6)
$$d(\eta) = U(q_c^{min}) - U(q_{c_over}) + \lambda_{fw} G(q_c^{max} - q_{c_over}) + \lambda_m f(\eta) e(q_c^{max} - q_{c_over}).$$

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

191 (7)
$$\frac{\partial d(\eta)}{\partial \eta} = \lambda_m f'(\eta) E(e(q_c^{max} - q_{c_over})) < 0.$$

192

193 **Experimental Methods**

194 In order to explore and estimate the effect of composting, a widely proposed food waste recycling
195 policy, an experimental study was conducted at large urban university during June and July of
196 2016. Participants were recruited from the university's student and staff population and from the
197 general population of the surrounding region. To limit self-selection bias, food waste was not
198 mentioned in the recruitment materials.

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

212 *Experimental Design*

213 Participants are randomly assigned to one of four treatments drawn from a 2 x 2 design (table 1):
214 (a) receive general information about the negative societal impacts of food waste and the mitigating
215 effects of composting (yes or no) x (b) destination of any uneaten food from the study (compost
216 or landfill). To ensure that the effects of design element (a) are not related to the extra time or

217 cognitive effort required to receive and process additional information, those who don't receive
218 information about food waste receive a control set of information about an unrelated topic
219 (financial literacy).

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

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

234 Respondents assigned to the first column of table 1 were informed that "...all uneaten food
235 will be placed in the facility's normal waste baskets, whose contents are placed in local landfills..."
236 Therefore, the perceived compost rate is zero ($\eta = 0$) and the internalized environmental cost is
237 $-\lambda_m E(q_t - q_c)$. In sessions from the second column of table 1, participants were informed that
238 "...all uneaten food will be sent to a compost facility so that emission of methane from the uneaten
239 food will be largely reduced and the compost generated can nourish soil for healthier plants and

240 gardens...” Hence, no food waste ends in landfill ($\eta = 1$) and participants internalize zero
241 environmental cost $f(\eta) = \lambda_m f(\eta) e(q_t - q_c) = 0$. For these sessions, all uneaten food was
242 deposited in a compost facility located on the University’s farm.

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

247 If we define that the participants who read and understood the food waste information card
248 as aware participants, $\lambda_{fw} = 1$ and $\lambda_m = 1$, they experience the full disutility from wasting food
249 $G(q_t - q_c)$ and may fully internalize the environmental cost generated from wasted food
250 $f(\eta) e(q_t - q_c)$. Those in the opposite treatment (top two rows of table 1) receive a similar length
251 information card and subsequent quiz about financial literacy (see Appendix for the card).
252 Financial literacy is unrelated to food, waste or food waste and helps ensure any estimated effects
253 are the result of information about food waste and not just a general informational effect or an
254 effect of the additional time delays prior to food consumption. Participants who read the
255 information card about financial literacy may still feel bad about wasting food based on knowledge
256 they had prior to the study. For example, one might assume $\lambda_{fw} = \frac{1}{2}$ based on a U.S survey in
257 2015 that found that about half of Americans are aware of recent coverage of the level of food
258 waste or food waste reduction efforts (Qi and Roe 2016). However, aware individuals may not
259 know the differences in environmental cost between food waste in landfills and composted food
260 waste ($\lambda_m = 0$). As a result, they may experience a partial negative emotion of wasting food (e.g.,
261 $\frac{1}{2} G(q_t - q_c)$) and may not fully internalize any perceived environmental costs of food waste in
262 landfill and will not appreciate the societal benefits from composting.

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

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

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

286 Order data includes the number of: 4-inch sandwiches (180g per sub), bags of apple slices (113g
 287 per bag), bags of chips (28.3g per bag), bottles of beverage (355ml per bottle) and bottles of water
 288 (355ml per bottle). Demographic characteristics (X_i) includes age, gender, race, education,
 289 employment, metro status of the place where the subject grew up, metro status of the place where
 290 the subject currently resides, and participant's responsibility for food shopping and meal
 291 preparation at home (Qi and Roe, 2016). Other demographic variables that feasibly affect
 292 participants' food waste behavior in this study include, participants' awareness about food waste
 293 before the study, and the participant's awareness of the purpose of this study prior to the exit
 294 debriefing. The participant's recycling frequency is also included to control for ongoing pro-
 295 environmental behaviors.

296

297 **Empirical Methodology**

298 Let y_i denote the grams of food waste for each participant i . Let the relationship between food
 299 waste, information treatments ($FW_i, Comp_i, FWxComp_i$), order size ($Order_i$), and participants'
 300 demographic characteristics (vector X_i) be:

$$301 \quad \log(y_i + 1) = \alpha + \theta_1 FW_i + \theta_2 Comp_i + \theta_3 FWxComp_i + \gamma Order_i + X_i' \beta + \varepsilon_i, \quad (8)$$

302 where the θ 's and γ are coefficients to be estimated and β is a conformable vector of demographic
 303 coefficients to be estimated. $FW_i = 1$ if the participant received the information about the negative
 304 social impacts of food waste and mitigating effects of compost, and $FW_i = 0$ if the participant
 305 received the information card about financial literacy. $Comp_i = 1$ if participant i is told that all
 306 uneaten food will be composted, while $Comp_i = 0$ if participant i is told that all the uneaten food
 307 will be disposed of in a landfill. $FWxComp_i$ is the interaction term of FW_i and $Comp_i$.

308 *Treatment versus Compliance*

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

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

325 To deal with the possible endogeneity of the perceived destination of uneaten food, we use
326 instrumental variable methods in which we (1) estimate a first-stage binary model (e.g, probit) of
327 compliance as a function of the random group assignments ($FW_i, Comp_i, FW \times Comp_i$) and
328 participants' awareness about food waste before the study, (2) predict the fitted probability of
329 believing the correct food waste destination information (\hat{p}_i), and (3) estimate the treatment effects
330 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
331 for $FW \times E[Comp_i]$.

332 However, another estimation complication exists. The data on food waste contains a large
333 percentage of observations featuring zero waste, and instrumental variable approaches yield
334 inconsistent estimates for nonlinear models that correct for censoring (e.g, Tobit). The commonly
335 used method for estimating such models, control function estimators, yields consistent estimates
336 only when the endogenous variable is continuously distributed. Our endogenous variable,
337 $E[Comp_i]$, is binary. Therefore, we also estimate models in which the dependent variable is binary
338 and equals 1 if any food has been wasted and equals 0 otherwise. These models are interpreted as
339 the effects of treatment on food waste at the extensive margin or, in other words, the fraction of
340 respondents who failed to ‘clean their plate’ during the dining session.

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

345

346 **Results**

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

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

365
366 In table 3 we present the treatment effects on the log grams of solid food waste. In all the
367 models, individual-level controls are included and robust standard errors are clustered by session.
368 In column 1, we present ordinary least squares (OLS) estimates as a baseline. In column 2, we
369 reproduce the analysis in column 1 using a Tobit model to correct for censoring. With random
370 assignment, the local average treatment effect (LATE) estimated from Tobit is equal to the average
371 effect of treatment on treated (ATT) if compliance were perfect. Compliance for *Comp* is not
372 perfect, however. As a result, the Tobit estimation is biased and requires IV to yield the ATT
373 (Angrist, et al., 1996). In column 3, we use instrumental variables (OLS-IV) to control for the
374 endogenous imperfect compliance, but cannot control for censoring due to the lack of implemental
375 IV approaches for models in which the endogeneous variable is binary.

376 The three models in table 3 show similar patterns. Enhanced awareness about food waste
377 significantly reduces the amount of solid food waste. The information effect of composting is
378 heterogeneous. The announcement about composting has no significant effect on food waste

379 unless the participants also received the food waste information card ($FW \times Comp$). For aware
380 participants, the crowd-out/rebound effect of composting is positive and significant and the
381 marginal effects of the two treatments offset (i.e., $FW + FW \times Comp = 0$, see table 3 for test
382 results). When censoring is corrected by a Tobit model or imperfect compliance is corrected by
383 IV, the estimated crowd-out/rebound effects ($FW \times Comp$) are larger compared to the ones estimate
384 by OLS and we continue in our failure to reject that $FW + FW \times Comp = 0$. Hence, we postulate
385 that our current estimates provide a lower bound for the actual crowd-out/rebound effect that
386 occurs when participants believe food waste will be composted.

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

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

402

403 **Discussion, Limitations and Policy Implications**

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

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

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

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

445 *Limitations and External Validity*

446 While the results of this particular dining experiment appear robust, we must grapple with
447 several limitations of the study. First, we must be aware that the magnitude of treatment effects

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

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

468 Second, study participants could order only once and could not engage in food storage.
469 Many food service settings allow consumers to order more than once (e.g., returning to the buffet
470 line for seconds or buying more food). Hence, it will be important to understand the frequency

471 with which consumers use these tactics and to gauge the marginal impact on the amount of food
472 wasted (e.g., are people more likely to not eat the food obtained during their second trip through
473 the buffet line?). On the food storage front it will be important to understand the following: the
474 frequency and volume of doggy bagged leftovers in dining settings, the likelihood that doggy bag
475 contents are subsequently consumed, and the dispensation of uneaten doggy bag contents (e.g.,
476 landfill, compost, etc). Understanding each element would allow a more precise calculation of net
477 social benefits of reduction and recycling policies in a food service setting.

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

487

488 **Footnotes**

- 489 1. Diners may also be uncertain of q_c^* at the time of ordering (e.g., not sure how hungry they are
490 or not sure how filling these particular food items will be). This could give rise to an expected
491 range of possible order sizes, hence yielding another mechanism that gives rise to values similar
492 to q_c^{min} and q_c^{max} and a set of results similar to the propositions derived here.
- 493 2. 15 observations are deemed outliers as defined by the modified recursive procedure (Selst and

494 Jolicoeur, 1994) and are excluded from all analyses.

495 3. All models are also estimated in levels and available in the Appendix. Model fit declines when
496 models are estimated in levels, though the qualitative treatment patterns are the same and the
497 level of significance remains similar in most cases.

498 4. p -values reported in this paragraph are from nonparametric Kruskal Wallis equality-of-
499 populations rank test.

500

501
 502
 503
 504

Tables and Figures

Table 1: 2x2 Experimental Design

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

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

510
 511

Table 2: Summary Statistics

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

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

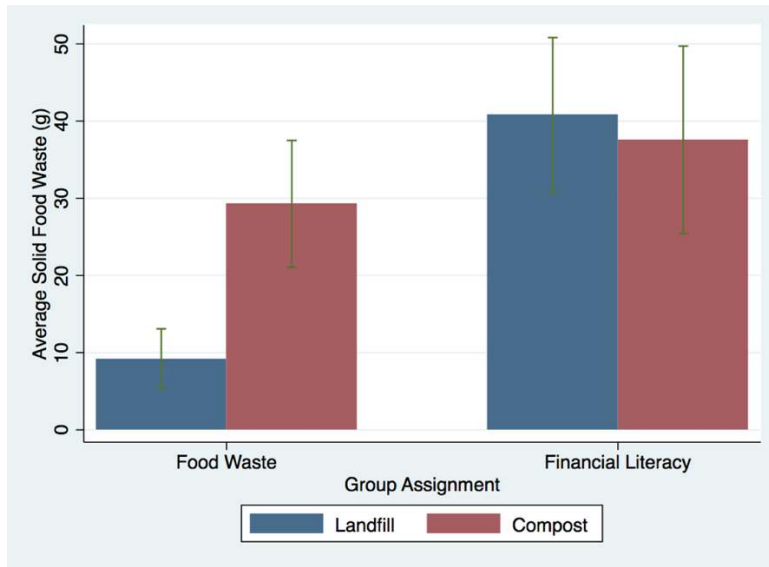
Variable	Base	Treatment Group			Total	p – value
		FW	Comp	FWxComp		
<i>Sandwich</i>	27 (68%)	6 (40%)	21 (55%)	20 (56%)	19 (56%)	0.000*** 0.023**
<i>Apple</i>	12 (27%)	2 (7%)	11 (29%)	9 (20%)	9 (20%)	0.050** 0.012**
<i>Chip</i>	1 (20%)	1 (9%)	5 (21%)	1 (14%)	2 (16%)	0.093* 0.259
<i>Beverages</i>	82 (80%)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

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

520
521
522
523
524

525
526

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



527
528
529

530
531

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			
<i>FW</i>	-1.503*** (0.312)	-1.536*** (0.353)	-2.137*** (0.504)
<i>Comp</i>	-0.275 (0.333)	-0.205 (0.352)	
<i>FW x Comp</i>	1.299** (0.560)	1.310** (0.635)	
Compliance			
<i>E[Comp]</i>			-0.306 (0.376)
<i>FW x E[Comp]</i>			2.000** (0.777)
<i>p: FW + FW x Comp = 0</i>	0.558 ^b	0.548	0.682
Observations	237	237	236
R-squared	0.297		0.288

532 *Note:* Robust standard errors clustered at the session level are in parentheses. *** $p < 0.01$, **
533 $p < 0.05$, * $p < 0.1$ *a* – The average marginal effect of the censored prediction is reported. *b* – *p*-
534 value from a *F*-test where the null hypothesis is $FW + FW \times Comp = 0$ (first two columns) or
535 $FW + FW \times E[Comp] = 0$ (last two columns).

536
537
538

539 Table 4: Marginal Treatment Effects on Solid Food Waste at Extensive Margin
 540 Dependent Variable = 1 if Solid Food Waste > 0; = 0 otherwise

VARIABLES	LPM (1)	Pobit ^a (2)	LPM-IV (3)
Group Assignment			
<i>FW</i>	-0.275** (0.105)	-0.255*** (0.864)	-0.393*** (0.135)
<i>Comp</i>	-0.074 (0.059)	-0.093* (0.056)	
<i>FW x Comp</i>	0.291* (0.135)	0.290*** (0.106)	
Compliance			
<i>E[Comp]</i>			-0.077 (0.066)
<i>FW x E[Comp]</i>			0.412** (0.172)
<i>p: FW + FW x Comp = 0</i>	0.809 ^b	0.494	0.764
Observations	237	237	236
R-squared	0.256		0.252

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

545

546

547

548

549

550

551

552 **References**

- 553 Andreoni, J., A. Payne, and S. Smith. 2014. "Do Grants to Charities Crowd Out Other Income?
554 Evidence from the UK." *Journal of Public Economics* 114:75-86.
- 555 Angrist, J.D., G.W. Imbens, and D.B. Rubin. 1996. "Identification of Causal Effects Using
556 Instrumental Variables." *Journal of the American statistical Association* 91:444-455.
- 557 Binswanger, M. 2001. "Technological Progress and Sustainable Development: What about the
558 Rebound Effect?" *Ecological Economics* 36:119-132.
- 559 Chan, N.W., and K. Gillingham. 2015. "The Microeconomic Theory of the Rebound Effect and
560 its Welfare Implications." *Journal of the Association of Environmental and Resource*
561 *Economists* 2:133-159.
- 562 Greening, L.A., D.L. Greene, and C. Difiglio. 2000. "Energy Efficiency and Consumption—the
563 Rebound Effect— A Survey." *Energy Policy* 28:389-401.
- 564 Just, D.R., and B. Wansink. 2011. "The Flat-rate Pricing Paradox: Conflicting Effects of “All-
565 you-can-eat” Buffet Pricing." *The Review of Economics and Statistics* 93:193-200.
- 566 Khazzoom, J.D. 1980. "Economic Implications of Mandated Efficiency in Standards for
567 Household Appliances." *The Energy Journal* 1:21-40.
- 568 Okawa, K. 2015. "Market and Trade Impacts of Food Loss and Waste Reduction." *OECD Food,*
569 *Agriculture and Fisheries Papers*, No. 75, OECD Publishing, Paris.
- 570 Parfitt, J., M. Barthel, and S. Macnaughton. 2010. "Food Waste within Food Supply Chains:
571 Quantification and Potential for Change to 2050." *Philosophical Transactions of the*
572 *Royal Society B: Biological Sciences* 365:3065-3081.
- 573 Peltzman, S. 1975. "The Effects of Automobile Safety Regulation." *The Journal of Political*
574 *Economy*:677-725.

575 Qi, D., and B.E. Roe. 2016. "Household Food Waste: Multivariate Regression and Principal
576 Components Analyses of Awareness and Attitudes among US Consumers." *PloS one*
577 11:e0159250.

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

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

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

585 Rethink Food Waste Through Economics and Data, 2016. "A Roadmap to Reduce U.S. Food
586 Waste by 20 Percent," available online at
587 http://www.refed.com/downloads/ReFED_Report_2016.pdf (accessed November 4,
588 2016).

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

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

593 Slovic, P., and E.U. Weber. 2002. "Perception of Risk Posed by Extreme Events." In Applegate,
594 Gabba, Laitos, and Sachs, eds., *Regulation of Toxic Substances and Hazardous Waste*
595 (2nd edition), Foundation Press, St. Paul, MN.

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

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

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

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

608

609

610 **Supplemental Appendix for Reviewers and Online Publication**

611

612

1. Welcome Sheet

613

2. Figure A1: Timeline of an Experiment Session

614

3. Figure A2: Food waste information card

615

4. Figure A3: Financial literacy information card

616

5. Quiz for FW and FW x Comp groups

617

6. Quiz for Base and Comp groups

618

7. Study Questionnaire

619

8. Tables of Supplementary Results

620

621

622

623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646

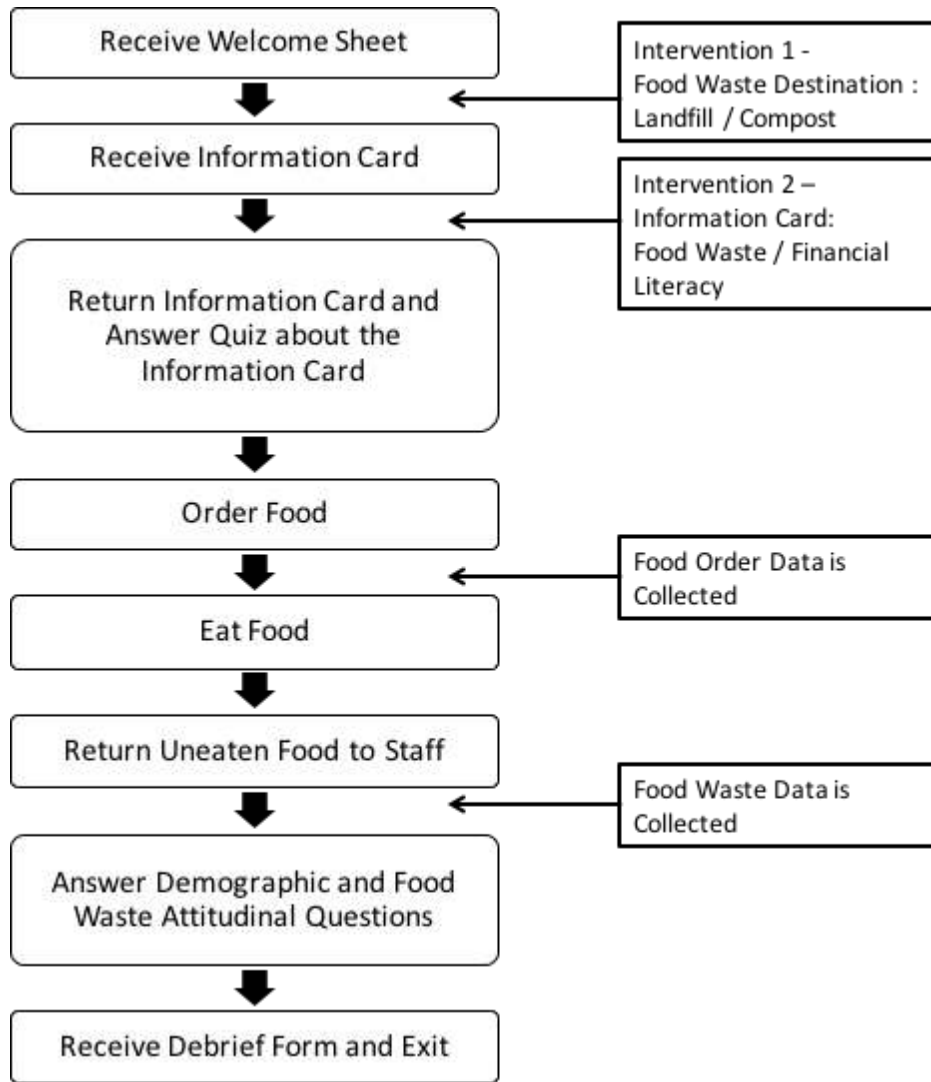
Ohio State Lunch Study – Welcome!

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.*

647
648
649

Figure A1: Timeline of an experimental session

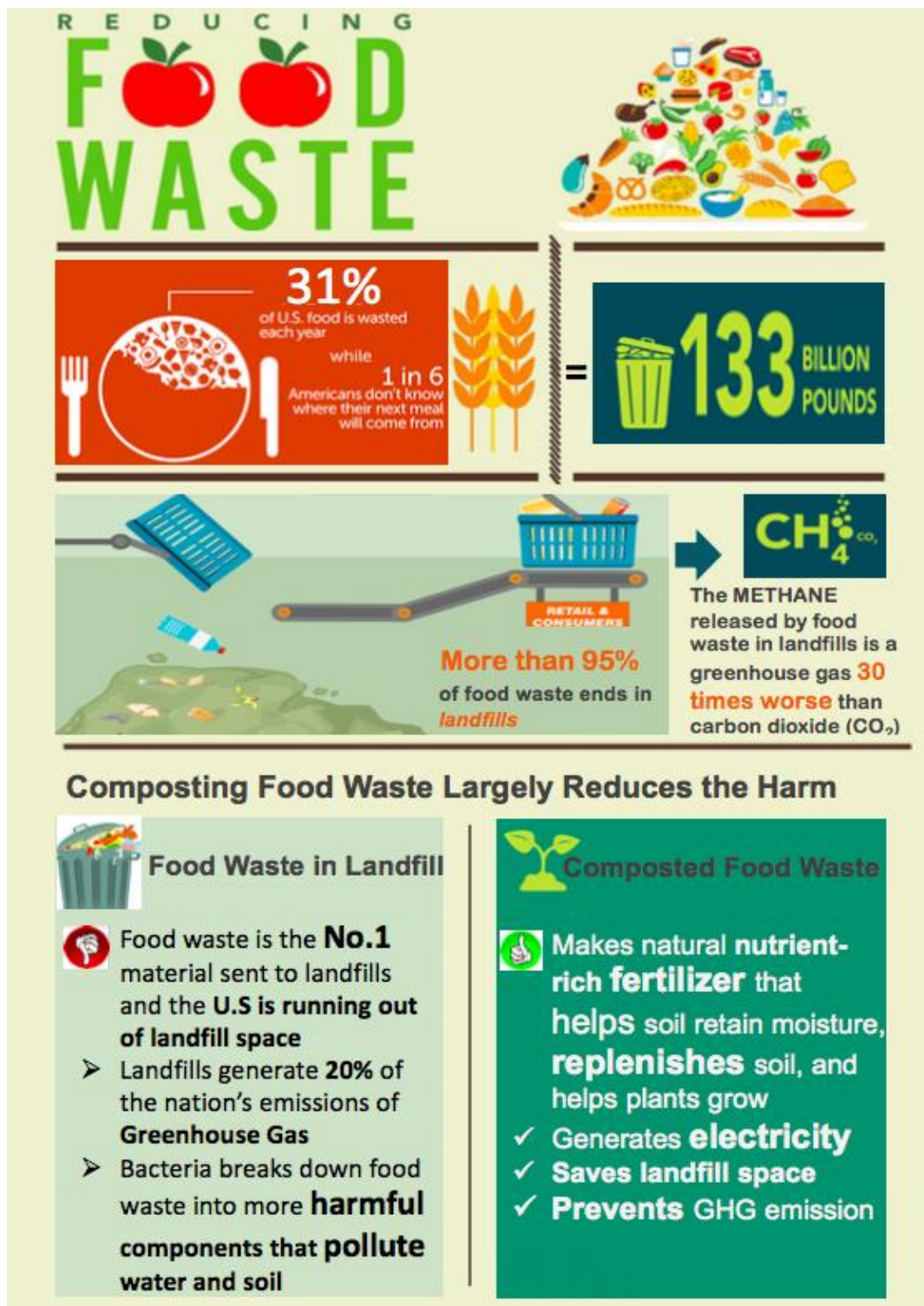


650
651

652

Figure A2. Food waste information card

653

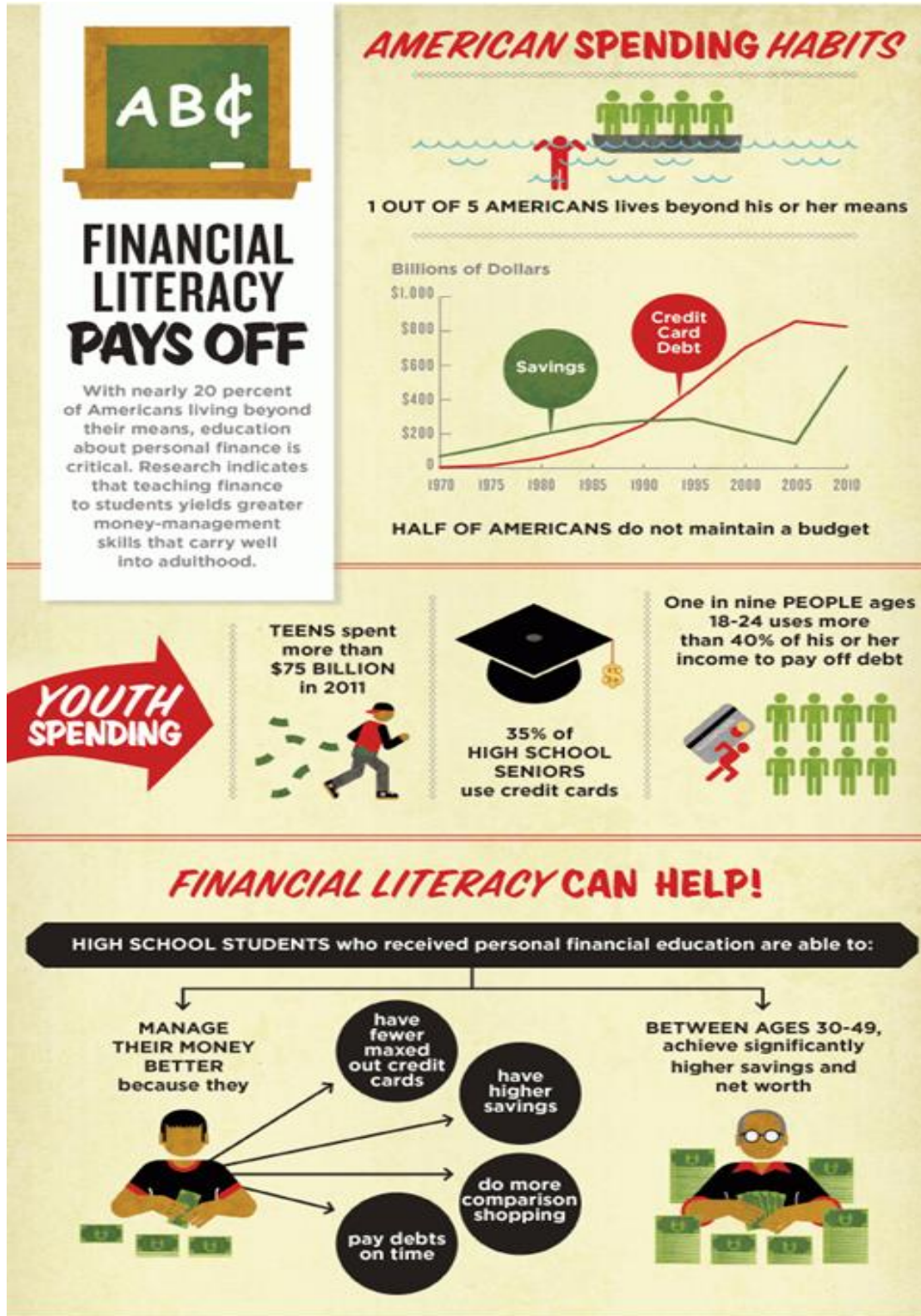


654

655

656
657

Figure A3: Financial literacy information card



658
659
660

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

662 Q1. How much food was left uneaten at the retail and consumer level in U.S. in 2010?

- 663 1. 5% of overall food supply (=21 billion pounds)
664 2. 11% of overall food supply (=47 billion pounds)
665 3. 31% of overall food supply (=133 billion pounds)
666 4. 61% of overall food supply (=262 billion pounds)

667

668 Q2. Food waste in landfill will generate_____.

- 669 1. Carbon Dioxide (CO₂)
670 2. Methane (CH₄)
671 3. Nitrous Oxide (N₂O)
672 4. None of these

673

674 Q3. How do methane and carbon dioxide compare in term of greenhouse gas?

- 675 1. Methane (CH₄) is more powerful than carbon dioxide (CO₂)
676 2. Carbon dioxide (CO₂) is more powerful than Methane (CH₄)
677 3. They are about the same

678

679 Q4. Based on the information card, how does the damage from food waste in landfills compare
680 to food waste sent to compost facilities?

- 681 1. Much less environmental damage from food
682 waste in landfills vs composting
683 2. Somewhat less environmental damage from
684 food waste in landfills vs composting
685 3. About the same
686 4. Somewhat more environmental damage
687 from food waste in landfills vs composting
688 5. Much more environmental damage from
689 food waste in landfills vs composting
690 6. Don't Know

691

692 Q5. Are you allowed to take any uneaten food away from this lunch?

- 693 1. Yes
694 2. No
695 3. Don't know

696

697 Q6[*FW*]. Where will the uneaten food from today's lunch be placed in?

- 698 1. Local facility, whose contents are placed in landfills
699 2. Organics disposal company
700 3. Don't know

701

702 Q6[*FW x Comp*]. Where will the uneaten food from today's lunch be placed in?

- 703 1. In a local facility, whose contents are placed in landfills
704 2. Composted to reduce the emission of methane and nourish soil
705 3. Don't know

706 **Quiz for *Base* and *Comp* Groups**

707 Q1. How many Americans lives beyond his or her means ?

- 708 1. 1 out of 3
- 709 2. 1 out of 5
- 710 3. 1 out of 10
- 711 4. 1 out of 20

712

713 Q2 How many Americans DO NOT maintain a budget?

- 714 1. One third of Americans
- 715 2. Half of Americans
- 716 3. 3 out of 4 Americans

717

718 Q3. Which of the following is true about American youth spending?

- 719 1. Teens spent more than \$75 billion in 2011
- 720 2. 35% of high school seniors use credit cards
- 721 3. One in nine people ages 18-24 uses more than 40% of his or her income to pay off debt
- 722 4. All of above

723

724 Q4. Which of the following is the solution provided by the information card?

- 725 1. Forbidding high school seniors using credit cards
- 726 2. Discourage teens from shopping alone
- 727 3. Teaching finance to high school students
- 728 4. None of them

729

730 Q5. How could financial literacy change high school students' financial behavior?

- 731 1. Have fewer maxed out credit cards
- 732 2. Have higher savings
- 733 3. Do more comparison shopping
- 734 4. Pay debts on time
- 735 5. All of the above

736

737 Q6. Are you allowed to take any uneaten food away from this lunch?

- 738 1. Yes
- 739 2. No
- 740 3. Don't know
- 741 4.

742 Q7[*Base*]. Where will the uneaten food from today's lunch be placed?

- 743 1. In a local facility, whose contents are placed in landfills
- 744 2. Organics disposal company
- 745 3. Don't know

746

747 Q7[*Comp*]. Where will the uneaten food from today's lunch be placed?

- 748 4. In a local facility, whose contents are placed in landfills
- 749 5. Organics disposal company
- 750 6. Don't know

751 **Questionnaire**

752 **Food handling**

753 Q1. How responsible are you for the food shopping and meal preparation in your home?

- 754 1. Mostly responsible
755 2. Somewhat responsible
756 3. Not at all responsible

757

758 Q2 [*Base & Comp*] In the last 12 months, have you read, seen or heard anything about the
759 amount of food that is wasted or about ways to reduce the amount of food that is wasted?

- 760 1. Yes
761 2. No
762 3. Uncertain

763

764 Q3 [*Base & Comp*] Do you think there is much less, somewhat less, about the same, somewhat
765 more or much more damage to the environment from food waste in landfills than from the
766 composted food waste?

- 767 1. Much less environmental damage from food waste in landfills vs composting
768 2. Somewhat less
769 3. About the same
770 4. Somewhat more environmental damage from food waste in landfills vs composting
771 5. Much more
772 6. Don't Know

773

774 Q2[*FW & FW x Comp*]. Before today's session, but in the last 12 months, have you read, seen or
775 heard anything about the amount of food that is wasted or about ways to reduce the amount of
776 food that is wasted?

- 777 1. Yes
778 2. No
779 3. Uncertain

780

781 Q3[*FW & FW x Comp*]. Before today's session, do you think there is much less, somewhat less,
782 about the same, somewhat more or much more damage to the environment from food waste in
783 landfills than from the composted food waste?

- 784 1. Much less environmental damage from food waste in landfills vs composting
785 2. Somewhat less
786 3. About the same
787 4. Somewhat more environmental damage from food waste in landfills vs composting
788 5. Much more
789 6. Don't Know

790

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

- 793 A. Throwing away food is bad for the environment

- 794 1. Agree strongly
795 2. Agree somewhat
796 3. Disagree somewhat
797 4. Disagree strongly
798 5. Don't Know
799
- 800 B. Throwing away food is a major source of wasted money in your household
801 1. Agree strongly
802 2. Agree somewhat
803 3. Disagree somewhat
804 4. Disagree strongly
805 5. Don't Know
806
- 807 C. Throwing away food if the package date has passed reduces the chance someone will get sick
808 from eating the food
809 1. Agree strongly
810 2. Agree somewhat
811 3. Disagree somewhat
812 4. Disagree strongly
813 5. Don't Know
814
- 815 D. You feel guilty when you throw away food
816 1. Agree strongly
817 2. Agree somewhat
818 3. Disagree somewhat
819 4. Disagree strongly
820 5. Don't Know
821
- 822 E. You don't have enough time to worry about the amount of food you throw away.
823 1. Agree strongly
824 2. Agree somewhat
825 3. Disagree somewhat
826 4. Disagree strongly
827 5. Don't Know
828
- 829 F. Sometimes it is necessary to throw away some food to make sure meals taste fresh and good
830 1. Agree strongly
831 2. Agree somewhat
832 3. Disagree somewhat
833 4. Disagree strongly
834 5. Don't Know
835
- 836 G. It would be difficult to reduce further the amount of food your household throws away
837 1. Agree strongly
838 2. Agree somewhat
839 3. Disagree somewhat

840 4. Disagree strongly

841 5. Don't Know

842

843 H. You throw away more food when you buy things in large packages or when you buy in large
844 quantities during a sale

845 1. Agree strongly

846 2. Agree somewhat

847 3. Disagree somewhat

848 4. Disagree strongly

849 5. Don't Know

850

851 I. Your household throws away more food than other households of your size

852 1. Agree strongly

853 2. Agree somewhat

854 3. Disagree somewhat

855 4. Disagree strongly

856 5. Don't Know

857

858 J. You left more food uneaten than other people eating lunch here today

859 1. Agree strongly

860 2. Agree somewhat

861 3. Disagree somewhat

862 4. Disagree strongly

863 5. Don't Know

864

865 Q5. Did you give any food to others during today's lunch?

866 1. Yes

867 2. No

868

869 Q6. Did you take any food from others during today's lunch?

870 1. Yes

871 2. No

872 Q7. Before starting this questionnaire, what do you think was the purpose of this study?

- 873 1. Eating habit
- 874 2. Nutrition study
- 875 3. Consumption habit
- 876 4. Food handling habit
- 877 5. Food waste habit
- 878 6. Didn't think about it
- 879 7. Other _____

880

881 Q8. Where will any food left over from your meal today be placed?

- 882 7. In a local facility, whose contents are placed in landfills
- 883 8. In an organics disposal company
- 884 9. It will be composted to reduce the emission of methane and nourish soil
- 885 10. Don't know

886

887 **Demographic Information**

888 Q9. What is your age (in years)?

889 _____ years

891

892 Q10. What is your sex?

- 893 1. Male
- 894 2. Female

895

896 Q11. Ethnicity origin (or Race): Please specify your ethnicity

- 897 1. White Non-Hispanic
- 898 2. Black Non-Hispanic
- 899 3. White Hispanic
- 900 4. Black Hispanic
- 901 5. Unspecified Hispanic
- 902 6. Asian/ Chinese/ Japanese
- 903 7. Native American/Alaska Native/Native Hawaiian/Pacific Islander
- 904 8. Other Race
- 905 9. Multiple Racial Identification

906

907 Q12. Marital Status: What is your marital status?

- 908 1. Single, never married
- 909 2. Married
- 910 3. Widowed
- 911 4. Divorced
- 912 5. Separated

913

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

- 916 1. Less than high school graduate
- 917 2. High school graduate
- 918 3. Some college
- 919 4. College graduate
- 920 5. Graduate or Professional school
- 921 6. (Currently enrolled) Undergraduate 1st year
- 922 7. (Currently enrolled) Undergraduate 2nd Year
- 923 8. (Currently enrolled) Undergraduate 3rd Year
- 924 9. (Currently enrolled) Undergraduate 4th Year
- 925 10. (Currently enrolled) Graduate or Professional Students

926
927 Q14. Employment: Are you currently...?

- 928 1. Full-time
- 929 2. Part-time
- 930 3. Retired
- 931 4. Homemaker
- 932 5. Student
- 933 6. Temporarily unemployed
- 934 7. Disabled/handicapped
- 935 8. Other not employed

936
937 Q15. Including yourself, how many people live in your households?

938 _____

939
940 Q16. How many of these are children under the age of eighteen years?

941 _____

942
943 Q17. How many of these adults are female?

944 _____

945
946 Q18. Which state/country did you grow up in?

947 _____

948
949 Q19. Which of the following best describes your metro status of the place where you grew up?

- 950 1. In a city
- 951 2. In an inner suburb
- 952 3. In an outer suburb
- 953 4. In a rural area
- 954 5. In another setting _____

955
956 Q20. Which of the following best describes your current residential setting? I live...

- 957 1. On campus
- 958 2. In a city
- 959 3. In an inner suburb
- 960 4. In an outer suburb
- 961 5. In a rural area

962 6. In another setting _____
963
964 Q21. Is your home owned or rented?
965 1. Owned
966 2. Rented
967
968 Q22. Do you have health insurance?
969 1. Yes
970 2. No
971 3. Don't know
972
973 Q23. What was your total household income before taxes during the past 12 months?
974 1. Less than \$50,000
975 2. \$50,000-\$99,999
976 3. More than \$100,000
977
978 Q24. When it comes to recycling cans, bottles and paper, which best describes your level of
979 activity? I recycle...
980 1. Whenever possible
981 2. Most of the time
982 3. Occasionally
983 4. Seldom
984 5. Never
985
986 Q25. Have you ever lived in a household where uneaten food was composted?
987 1. Yes
988 2. No
989 3. Unsure
990
991
992
993
994
995
996

997
998
999

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			
<i>FW</i>	-31.249*** (3.862)	-30.919*** (11.284)	-43.623*** (7.328)
<i>Comp</i>	-6.747 (5.012)	-5.188 (6.374)	
<i>FW x Comp</i>	25.822** (9.384)	24.698 (15.011)	
Compliance			
<i>E[Comp]</i>			-7.572 (5.625)
<i>FW x E[Comp]</i>			39.637*** (13.612)
Observations	237	237	236
R-squared	0.295		0.272

1000
1001
1002
1003
1004
1005

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

1006
1007

Table A2. Marginal Treatment Effects on the Solid Food Order

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

1008
1009

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

1010
1011
1012

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

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

1013
1014
1015
1016

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

1017
1018

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			
<i>FW</i>	-1.309*** (0.363)	-1.730* (0.897)	-1.882*** (0.520)
<i>Comp</i>	-0.207 (0.328)	-0.224 (0.324)	
<i>FW x Comp</i>	1.123* (0.516)	1.454* (0.754)	
Compliance			
<i>E[Comp]</i>			-0.238 (0.379)
<i>FW x E[Comp]</i>			1.763** (0.722)
Observations	237	237	236
R-squared	0.275		0.250

1019
1020
1021
1022
1023

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

1024
1025

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

VARIABLES	LPM	Probit	LPM-IV
Group Assignment			
<i>FW</i>	-0.273* (0.130)	-0.265** (0.115)	-0.415*** (0.158)
<i>Comp</i>	-0.058 (0.072)	-0.056 (0.063)	
<i>FW x Comp</i>	0.261* (0.130)	0.252** (0.115)	
Compliance			
<i>E[Comp]</i>			-0.076 (0.084)
<i>FW x E[Comp]</i>			0.415** (0.170)
Observations	237	237	236
R-squared	0.238		0.200

1026
1027
1028
1029
1030

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

1031
1032

Table A6. Marginal Treatment Effects on the Sandwich Order

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

1033
1034
1035

Robust standard errors clustered at the session level in parentheses

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

1036
 1037
 1038

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

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

1039
 1040
 1041
 1042

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

1043
1044

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			
<i>FW</i>	-0.695** (0.314)	-1.418 (1.683)	-1.011*** (0.333)
<i>Comp</i>	-0.241 (0.390)	-0.371 (0.570)	
<i>FW x Comp</i>	0.772* (0.425)	1.528 (1.928)	
Compliance			
<i>E[Comp]</i>			-0.251 (0.407)
<i>FW x E[Comp]</i>			1.104** (0.491)
Observations	237	237	236
R-squared	0.196		0.189

1045 Robust standard errors clustered at the session level in parentheses *** p<0.01, ** p<0.05, *
1046 p<0.1

1047

1048

1049
1050

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

VARIABLES	LPM	Probit	LPM-IV
Group Assignment			
<i>FW</i>	-0.191** (0.087)	-0.258*** (0.074)	-0.291*** (0.095)
<i>Comp</i>	-0.056 (0.099)	-0.083 (0.217)	
<i>FW x Comp</i>	0.228* (0.111)	0.331*** (0.079)	
Compliance			
<i>E(comp)</i>			-0.056 (0.104)
<i>FW x E[Comp]</i>			0.335** (0.132)
Observations	237	230	236
R-squared	0.196		0.192

1051 Robust standard errors clustered at the session level in parentheses*** p<0.01, ** p<0.05, *
1052 p<0.1
1053
1054

1055

Table A10. Marginal Treatment Effects on the Apple Order

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

1056
1057
1058
1059
1060

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

1061
 1062
 1063

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

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

1064
 1065
 1066
 1067

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

1068
1069

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			
<i>FW</i>	-0.131 (0.128)	-0.106 (0.257)	-0.257* (0.142)
<i>Comp</i>	0.155** (0.064)	0.130 (0.252)	
<i>FW x Comp</i>	0.023 (0.139)	-0.018 (0.160)	
Compliance			
<i>E[Comp]</i>			0.143* (0.085)
<i>FW x E[Comp]</i>			0.200 (0.174)
Observations	237	237	236
R-squared	0.230		0.229

1070
1071
1072
1073
1074

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

1075
1076

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

VARIABLES	LPM	Probit	LPM-IV
Group Assignment			
<i>FW</i>	-0.077 (0.047)	-0.046 (0.044)	-0.148*** (0.050)
<i>Comp</i>	0.034 (0.027)	0.079** (0.035)	
<i>FW x Comp</i>	0.074 (0.052)	0.006 (0.045)	
Compliance			
<i>E[Comp]</i>			0.025 (0.036)
<i>FW x E[Comp]</i>			0.165** (0.070)
Observations	237	199	236
R-squared	0.286		0.290

1077
1078
1079
1080
1081
1082

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

1083
1084

Table A14. Marginal Treatment Effects on the Chip Order

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

1085
1086
1087

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

1088
1089
1090

1091
1092
1093

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

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

1094
1095
1096
1097

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

1098
1099
1100

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			
<i>FW</i>	-1.562*** (0.317)	-1.441* (0.818)	-1.963*** (0.422)
<i>Comp</i>	-1.351*** (0.236)	-1.330* (0.700)	
<i>FW x Comp</i>	1.558*** (0.358)	1.477* (0.849)	
Compliance			
<i>E[Comp]</i>			-1.636*** (0.228)
<i>FW x E[Comp]</i>			2.000*** (0.477)
Observations	237	237	236
R-squared	0.376		0.365

1101
1102

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

1103
 1104
 1105
 1106
 1107
 1108
 1109
 1110
 1111
 1112
 1113
 1114
 1115
 1116
 1117
 1118
 1119
 1120
 1121

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

VARIABLES	OLS	Tobit	OLS-IV
Group Assignment			
<i>FW</i>	-0.348*** (0.076)	-0.339*** (0.052)	-0.426*** (0.105)
<i>Comp</i>	-0.291*** (0.053)	-0.305*** (0.036)	
<i>FW x Comp</i>	0.348*** (0.089)	0.363*** (0.074)	
Compliance			
<i>E[Comp]</i>			-0.344*** (0.061)
<i>FW x E[Comp]</i>			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

1122
1123

Table A18. Marginal Treatment Effects on the Beverage Order

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

1124
1125
1126
1127
1128

1129
1130
1131

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

1132

Table A19: Marginal Treatment Effects on Solid Food Waste

1133

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

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

Perceived Environmental Damage from
Food Waste in Landfill Compared to
Composted Food Waste (before the study)

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

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

1134
1135
1136
1137

1138
1139
1140
1141
1142
1143

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

1144

Table A20: Marginal Treatment Effects on Solid Food Waste

1145

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

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

Perceived Environmental
Damage from Food Waste in
Landfill Compared to
Composted Food Waste (before
the study

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

Metro Status: grew up	(0.068)	(0.219)	(0.051)
<i>Inner Suburb</i>	0.016	0.073	0.022
	(0.121)	(0.466)	(0.109)
<i>Outer Suburb</i>	-0.068	-0.272	-0.097
	(0.103)	(0.320)	(0.087)
<i>Rural Area</i>	-0.206*	-0.722**	-0.251**
Metro Status: Residence	(0.110)	(0.368)	(0.100)
<i>City</i>	-0.011	-0.054	-0.038
	(0.062)	(0.176)	(0.048)
<i>Inner Suburb</i>	-0.144	-0.536	-0.187**
	(0.101)	(0.334)	(0.086)
<i>Outer Suburb</i>	-0.060	-0.289	-0.098
	(0.114)	(0.362)	(0.086)
<i>Rural Area</i>	-0.091	-0.427	-0.103
Recycle	(0.127)	(0.333)	(0.113)
<i>Most of the time</i>	-0.029	-0.096	-0.016
	(0.081)	(0.235)	(0.068)
<i>Occasionally</i>	0.203*	0.818**	0.203**
	(0.096)	(0.396)	(0.087)
<i>Seldom</i>	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

1146

1147

1148

1149

1150

1151

1152

Robust standard errors clustered at the session level in parentheses

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

1153

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

1154

Dependent Variable = E[Comp]

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

1155

1156

1157

1158

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

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

	(0.064)	(0.062)
<i>Inner Suburb</i>	0.082	0.078
	(0.071)	(0.053)
<i>Outer Suburb</i>	0.062	0.113
	(0.091)	(0.076)
<i>Rural Area</i>	0.016	0.040
	(0.109)	(0.108)
Recycle		
<i>Most of the time</i>	0.004	-0.013
	(0.068)	(0.057)
<i>Occasionally</i>	0.004	0.020
	(0.068)	(0.053)
<i>Seldom</i>	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

1159

1160

1161

1162

1163

Table A23: Instrumental Variable Tests

1164

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

1165