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**Determinants of consumer food waste behaviour: Homo Economicus vs. Homo Moralis**

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*Selected Paper prepared for presentation at the 2016 Agriculture and Applied Economics  
Association Annual Meetings, Boston, Massachusetts, July 31-August 2*

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## **Determinants of consumer food waste behaviour: Homo Economicus vs. Homo Moralis**

### **Introduction**

Food losses and waste (FLW) or food wastage include the edible portions of foods that are intended for human consumption but that are not consumed by human (FAO, 2011). Food losses generally refer to unintended spills or spoilage or technical problems that reduce production before it reaches a buyer or consumer. Food waste is generally associated with behavior such as negligence or conscious decisions to discard food (Lipinski et al, 2013). This research is motivated by the increasing concern about food waste in Canada and many other countries. European Parliament had declared 2014 as the ‘year against food waste’ in their 2012 special resolution and called on the European Commission to have 2012 food waste volumes halved by the year 2025 (European Parliament, 2012). Resonating similar sentiments, the G 20 Meeting of the Agricultural Chief Scientists (MACS) in 2015 recognized that the food lost and waste (FLW) is a global problem of enormous economic, environmental and societal significance. Nearly a third of the global food production for human consumption is wasted (FAO, 2013) where about 2.2 billion people live in poverty or near poverty, some with serious food deprivations (UNDP, 2014). Global food waste collectively releases about 3.3 billion tons of greenhouse gases which in turn equivalent to wasteful use of about 250 km<sup>3</sup> water and 1.4 billion hectares of land (FAO, 2013). The Waste and Resource Action Program of U.K. estimated that in the U.K. avoidable household food waste per capita contributed 330 kg CO<sub>2</sub> equivalent per year, which is a third of CO<sub>2</sub> emission from per capita electricity use in the households (WRAP 2011a and 2011b). Thus, mitigating food losses (those occurring in production, post-harvest and food processing) and waste (those occurring in distribution and consumption) not only prevent economic losses to the households and other players of agri-food

industry but also would prevent nontrivial negative spillovers on environment and natural resource use (Dorward, 2012; Gentil et al., 2011).

One may argue that in the world of Homo Economicus food waste is an anomaly because waste is irrational behaviour for a Homo Economicus. Some estimates shown that avoidable food waste is costly to households, where in UK this is about sterling pound 480 per year (or 15% of their food and beverage expenditure: WRAP, 2009); in U.S. about \$ 936 per year (Buzby and Hyman, 2012). Paradoxically, households are responsible for the largest share of the food wastage in many countries. For example, consumers contribute more than 50% of food waste in Europe (Kummu et al. 2012); about 60% in the U.S. (Griffin et al. 2009), and more than half in most other developed countries (Parfitt et al. 2010). In Canada, the estimated total value of food loss and waste is about \$31 billion in 2013 and the largest contributor (47%) was Canadian consumers (Gooch et al. 2014). Hence, extant literature on food waste and losses emphasises the importance of understanding food waste behaviour at the consumer level to develop appropriate strategies to reduce food waste (Stancu et al., 2016; Parizeau, et al., 2015; Diaz-Ruize, et al., 2015; Quested et al., 2013; Koivupuro et al., 2012; Evans, 2011).

Despite this increasing concern about consumer level food waste behaviour, there is a dearth of empirical analyses (Evans, 2011; Stefan et al. 2013; Stancu et al. 2016). Our research reported here attempts to answer the question of whether the drivers of food purchasing decisions of the consumers are systematically associated with the consumer level food waste behaviour in Canada. Consumers' food waste behaviour may be systematically associated with the drivers of food purchasing decisions which are in turn based on intrinsic and extrinsic food attributes. For instance, some consumers are willing to pay more for food attributes such as locally produced and/or organics due to their concerns of negative environmental impacts of conventional food

production and distribution systems. Such environmental concerns may also motivate consumers to prevent or reduce food waste. Similarly, health-conscious or ethical-conscious consumers may also have food waste behaviour consistent with such preferences. For understanding systematic associations between drivers of food purchasing decisions and food waste behaviour is useful in developing strategies and behavioural modifications to prevent or reduce consumer level food waste. For example, Waste and Resource Action Program (WRAP), a not-for profit Company established in 2006 by the four national governments of the United Kingdom, developed one of the earliest attempts to engage public and raise their awareness of food waste (WRAP, 2009). Many of their initiatives, such as “*Love Food Hate Waste*” are based on the idea of encouraging cooking methods and recipes from leftover ingredients to prevent food waste (Evans et al. 2013). Others also have noted the significance of educating consumers in “food skills” in terms of assessing food and managing and planning food purchasing and handling (Aschemann-Witzel et al. 2015; Farr-Wharton, 2014; Stancu, 2016).

Moral suasion for avoiding food waste may be another avenue to engage the public by appealing to consumers’ morality on the significant environmental, natural resource depletion and food security issues that are directly influenced by household food wastes, especially when the decision to waste food is not a conscious decision. Promise for appealing to consumer morality to avoid food waste is to some extent depends on whether there is evidence for a link between “consumer moral status” towards food and issues surrounding food production and their food waste behaviour. Evans (2011) provides a pointer to such a linkage where he claimed that: “*More generally, virtually, every respondent informed me that “it is wronged to waste food” and that they “felt awful” about the instances in which they end up doing so*” (p.437). However,

relationships of consumer food waste behaviour and their ethical and moral dimensions related to foods and food production issues are only sparsely addressed in the literature.

## **OBJECTIVES:**

This research is motivated to understand whether there are systematic relationships between the food waste behaviour and food attributes (extrinsic and intrinsic) that influence consumers' food purchasing decisions. The objectives of the present study are two-fold. First, we want to identify whether the intrinsic and extrinsic food attributes play significantly different roles as drivers of food purchasing decisions among Canadian consumers. We explore this objective with 12 food attributes among which seven are extrinsic food attributes (price, organic certification, fair trade label, free range label, eco-friendly label, heart and stroke foundation endorsement, healthy brand label) and five are intrinsic food attributes (nutritional value, safety, quality, impact on environment, locally produced) by determining their importance in food purchasing decisions. Among these there are many food attributes that are related to moral aspects in food production such as fair trade labels, eco-friendly label and free range label.

We want to explore whether such a diverse set of extrinsic and intrinsic food attributes are reducible to broader latent constructs that capture the drivers of food purchasing decisions. Second, in order to test our hypothesis about the association between the drivers of food purchasing decisions based on the above food attributes and the consumer level food waste, we want to relate those latent constructs systematically with the volume of consumer level food waste. We will test this hypothesis across five main reasons that the literature identify for consumers to waste food: “buying more than your household can eat or store”; “due to package sizes that are too large”; “due to food that is not eaten by the best before date”; “due to preparing

too much at mealtimes” and “due to someone in the household not liking the taste” based on the volume of food waste attributable to these five reasons.

## **DATA AND METHODOLOGY:**

The consumer survey, from which we have obtained our data, was designed by the Centre for Food in Canada of the Conference Board of Canada. The Forum Research, a Toronto-based market and consumer research firm, was contracted by the Conference Board of Canada to undertake the random digit dialing telephone survey among Canadian consumers. There were 1128 respondents over the age of 18 years from a nationally representative sample in Canada. All the questions for the food attributes were asked in the following manner: “when deciding what food to buy, how important is the “attribute x”. The rating was done with a 5 point Likert scale (not at all important=1 to extremely important=5). The ratings of these 12 attributes were subjected to a principal component analysis to identify broader latent constructs as the drivers of food purchasing decisions.

The food waste behaviour is evaluated with following question: “On average, how many grocery bags of food that you buy each week you ended up throwing out?” The responded were given choices of none; one; two; three or four and finally five or more. In addition, the survey also inquired certain reason for food waste in the following approach: “How much of the food that you throw out is due to: “buying more than your household can eat or store”; “due to package sizes that are too large” etc. In the estimation steps we discuss some of the weaknesses of these question formats and potential ways to control any biases introduced.

Table 1 compare the relative significance of food attributes in consumers’ food purchasing decisions. Many studies have in general identified, food quality, nutritional status, food safety

status and price are major drivers of food purchasing decisions of Canadian consumers (IPSOS-REID, 2010). The present data also show the significance of such major drivers of food purchasing decisions where, 85.7% of the respondents indicated that food quality status is “extremely or very” important when deciding what food to buy. The average Likert scale score (4.1 out of 5) is statistically significantly higher ( $p < 0.005$ ) than the mean rating scores of other food attributes. The motives of food purchasing that are associated with “consumer moral compass” has received low ratings in general and their means are significantly smaller than the mean rating scores for food attributes such as “nutritional value” and “price” etc.

**INSERT TABLE 1 HERE**

#### **Food waste behaviours of Canadians**

About two thirds of Canadian households throw out less than a grocery bag of food from their weekly food purchases (Figure 1). About 1.6 percent of household throw away more than five grocery bags of their weekly purchased foods. Such preliminary numbers indicate a wide variation in food waste behaviour among Canadians.

**INSERT FIGURE 1 HERE**

Answering the question of “How much of the food that you throw out is due to” question is portrayed in Figure 2. For about ten percent of households that experience food waste, the most of it occurred due to “not eaten by the best before or use by date”. Larger package size (perhaps with the discounted price for per weight or volume basis) too is an important reason due to which about eight percent of household throw out food.



## INSERT FIGURE 2 HERE

Linking these rating scores for 12 food attributes directly with household food waste volumes is a cumbersome and inefficient. The covariation between the rating scores of 12 food attributes and food waste behaviour at the household level could be usefully done by understanding the latent structures of consumer preferences that manifest through the rating scores for these 12 food attributes. Such latent constructs can be obtained with a data reduction method in multivariate statistical methods. The principal component analysis is a robust statistical method to reduce the number of variables by describing a series of uncorrelated linear combinations of the original variables that contain most of their variance (Thompson, 2004). Such linear combinations of the original variables may suggest useful underlying themes or “latent constructs” among these 12 food attributes.

The preliminary statistical testing leading to PCA indicated the appropriateness of the sample data for PCA. The first such test is the Bartlett's test of sphericity to determine whether the correlation matrix among the 12 food attributes is an identity matrix (i.e. all the off-diagonal elements are zero and the diagonal consists of ones) which would indicate that food attributes are perfectly uncorrelated hence no scope for data reduction (Thompson, 2004). The null hypothesis of the Bartlett's sphericity test, i.e. the correlation matrix is an identity matrix is rejected with the chi-square value of  $\chi^2 = 4410$  (degrees of freedom = 66) ( $p < 0.000$ ). The correlation matrix indicated that many of the 12 food attributes are strongly positively correlated.

The second such test is the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy test. This test determines whether the partial correlations (i.e. correlation between any two food-attributes after accounting for all the other attributes) are small. If these 12 attributes capture a

broader construct of “drivers of food purchasing”, then the 12 food attributes belong together. When these attributes belong together, as a component of a broader unique construct, pairwise correlations between any two variables after accounting for all the variables (i.e., partial correlations) should be small (Kaiser, 1974). The value of KMO measure of sampling adequacy will be one when the sum of such partial correlations is zero. In the other extreme, the KMO will reach zero as the sum of partial correlations increases relative to the sum of pairwise (zero order) correlations. Kaiser, (1974) suggested that the KMO score of above 0.8 is “meritorious” for factorial simplicity and the KMO test result for this data set was 0.875. The PCA used a varimax rotation. There were three principal components with eigenvalues greater than one, which collectively explained 60.3 percent of the variation (0.2492+0.1964+0.1579) in the responses across the sample as a whole (Table 2).

## **INSERT TABLE 2 HERE**

The first principal component (Factor 1) had heavy loadings (these are the correlation coefficients between a given food attribute and the “conceptual construct” as suggested by the principal component) from: organic certification, fair trade label, raised free range label, produced for eco-friendly label, locally produced, and impact on environment . These food attributes are broadly about the “ethical drivers” in food purchasing decisions and could be more important than other drivers for *homo moralis*. The second principal component (Factor 2) had heavy loadings from: nutritional value, price, food safety status, and food quality status. These food attributes are “value-seeking drivers” in food purchasing decisions and could be more important than other drivers for *homo economicus*. The factor loading for price is negative in Factor 1

(ethical drivers) indicating that some of the food attributes for “value-seeking drivers” are negatively related to the “ethical drivers”. The third principle component (Factor 3) has heavy loadings from food attributes such as “Healthy Brand label” and “Endorsement by Heart and Stroke Foundation” which are linked to the “health-seeking drivers” in food purchasing.

To assess the relative importance of the three broader constructs captured by the three principal components, multi-item scales were derived on the basis of the items (food attributes) that loaded heavily on each principal component (Table 3). In justifying creation of the multi item scale, one needs to demonstrate that these items jointly measure the same broader construct. The items in a multi item scale are said to be internally consistent (item homogeneity) and reliable when the items measure the same construct. The greater the inter item correlations the higher would be the internal consistency and the reliability of these items. The most widely used estimate of items’ internal consistency and reliability is Cronbach’s  $\alpha$ <sup>1</sup> (Henson, 2001).

All items in the scales were judged to be reliable on the basis of the value of the Cronbach’s  $\alpha$  (Table 3); they had an  $\alpha$  value exceeding 0.70 (Nunnally, 1978). On the basis of principal axis factoring, these scales also demonstrated unidimensionality (Spector, 1992) which is an indication that these items in each of the multi item scale are measuring one broader construct (see the Cronbach’s  $\alpha$  values for the three scales in Table 3). All the food attributes had factor loadings that exceeded 0.49. Average multi-item scale for “value-seeking drivers” (3.80) for the

---


$$^1 \text{Cronbach's } \alpha = \frac{k}{k-1} \left[ 1 - \frac{\sum_{i=1}^k \sigma_i^2}{\sum_{i=1}^k \sigma_i^2 + (\sum_{i < j} COV_{ij} \times 2)} \right];$$

k = number of items in a multi-item scale;  $\sigma_i^2$  = variance of the individual item;  $COV_{ij}$  = covariance between the items i and j where  $i < j$ . When the covariances between individual items are zero (i.e. no internal consistency or reliability), the denominator and the numerator of the bracketed term will be the same, hence the Cronbach’s  $\alpha$  will be zero. When the items are perfectly correlated (i.e. higher covariance), one would find perfect internal consistency, where Cronbach’s  $\alpha$  tends to be one (weighted through the number of items (k) in the scale) (Henson, 2001).

all sample is statistically significantly higher ( $p < 0.000$ ) than those for the “ethical drivers (2.84) and “health –seeking drivers (2.95).

### **INSERT TABLE 3 HERE**

The main motivation of this research is to explore whether these different drivers of food purchasing behaviour are systematically associated with the household level food waste behaviour. One may argue that significant negative environmental spillovers of food waste would prompt the households with higher ratings for “ethical drivers” to be vigilant about food waste and put effort to reduce it. Such a relationship may not be discernible for the households with higher ratings for “value-seeking drivers”. However one may argue that the households with higher levels of “value-seeking drivers” in food purchasing may also put effort to reduce food waste due to frugality reasons. Such knowledge would be useful in designing strategies to communicate with consumers and “nudge” the consumers to avoid wasteful behaviours appealing to their morality in combating household level food waste behaviours. We are curious to see whether consumers with higher ratings on “ethical drivers” could be nudged to do more on reducing food waste behaviours.

### **Potential co-variates of household food waste behaviour**

Is there any systematic association between the reported values of food waste volumes and the “drivers of food purchasing decision”? In order to address this question, we have estimated a series of limited dependent variable models both binary and ordered versions. The logit regressions were undertaken with the dependent variable where “None” for the food waste

answer (see Figure 1) as zero and any other levels as one. This was attempted due to the possible measurement error in the “ranking” introduced by the question about volume of food waste, where the yardstick (grocery bag) may be unclear in the mind of respondents. However, the results of ordered logit and binomial logit regressions were not very different and the Likelihood Ratio (LR) test between the two models indicated the ordered logit regression has more explanatory power. Hence, our reported results are confined to the ordered logit results.

There are some data on socio-economic variables and some knowledge variables collected by this survey which may explain variation of the food waste behaviour. Since we are using the STATA factor variable approach for the purpose of evaluating marginal effects more accurately (Williams, 2012), the original categories of most socio-economic explanatory variables (age, income etc.,) were left unchanged (see Table 4).

Household income could influence food waste behaviour. All else equal, lower income household would be more frugal with their food purchasing and preparation activities. Literature reported positive association between household income and food waste volumes (Kiovupuro et al. 2012; Brook, 2007; Engstrom and Carlsson-Kanyama, 2004; Buzby and Guthrie, 2002) as well as little or no association (Wenlock et al. 1980 and Dowler, 1977).

We have included “distance to the grocery store from which majority of groceries are bought”. We argue that all else equal, inconvenience of travelling longer distances might prompt families to overstuff their food storages which might lead to food waste if meal preparations are not planned meticulously. We have not seen much from the literature about the importance of distance variable and household food waste.

Impulsive, away from home dining (especially as whims of children) may lead to food waste if already purchased foods for preparing meals are overlooked. All else equal, such away

from home impulsive dining is easier if food services are easily accessible. We have used “number of fast food restaurant between home and the nearest grocery store” as a variable to capture this aspect of “easily accessible away from home dining”. However, it must be noted that if dining away from home is properly planned that may lead to less food waste at home. Yet, such planned activities may not be as much influenced by the “accessibility” to fast food.

Food literacy and knowledge about the food preparations and nutrition may lead to lower household food waste. Previous research reiterated the significance of food literacy and knowledge in reducing household food waste (WRAP, 2014; Farr-Wharton et al. 2014; Stefan et al. 2013). We have used “whether the respondent is extremely or very confident in using Nutrition Fact Table in making healthy food choices” as a proxy to capture the respondents food related knowledge. Age and gender have customarily used in the household food waste behaviour studies and have shown that in general women are more prone to waste food and so is young compared to old (Aschemann-Witzel et al. 2015).

The descriptive statistics of these variables are in Table 4. There are significant omissions of important covariate in this data that are likely to be associated with household food waste. We cannot easily compensate for such omissions. For example, we do not have a good variable to control the household size and the educational attainment both will have significant bearing on household level food waste behaviour. Despite such glaring inadequacies of data, we do believe that our empirical work would contribute to the very limited literature on the empirical analysis of household food waste behaviour in Canada.

INSERT TABLE 4 HERE

## **Regression results and their interpretations**

Ordered logit regression for the “general food waste” is reported in Table 5. The model F value (2.73) is significant at  $p < 0.000$  indicating good fit of the model to the data (since we have used weighted data with svy prefix in STATA other model fit parameters are not available).

### **INSERT TABLE 5 HERE**

The “ethical drivers” of food purchasing decisions has a negative and statistically significant ( $p < 0.01$ ) coefficient. This negative relationship adduces evidence for inverse relationship between ethical motives in food purchasing and tendency to waste food at household level. The 95% confidence interval for this coefficient stays within negative values indicating that the negative relationship is robust. We also observe negative yet statistically insignificant coefficient for “value-seeking motives” in food purchasing, however in the 95% confidence interval the sign changed from negative to positive indicating that the effects is not strong for the sample. The “health-seeking motives” of food purchasing do not have systematic association with household level food waste behaviour and the coefficient is positive while not statistically significant at the conventional levels.

Our data do not identify any significant association between age of the respondent and the household food waste volumes. Although not statistically significant the coefficient across age categories indicated that both 25 to 34 and 35 to 44 years old groups have positive coefficients relative to the omitted age category (18 to  $< 25$  years), but the three older age categories have negative coefficients, providing some support for the notion that young consumers tend to have higher food waste volumes relative to the older counterparts. Perhaps,

effect of the age variable may be masked by household size, which we do not account for in the model.

Household before tax incomes are not stronger predictor of the household level food waste. Though, both highest income class and second lowest income class have positive association between income and household food waste volume, relative to the omitted income class of less than \$ 40,000, the middle income group has a negative coefficient indicating inconsistent effect pattern across income classes on their food waste behaviours. We have not obtained any systematic association between the distances to the grocery store where the majority of food is purchased and the size of household food waste.

The number of fast food restaurants between the house and closest grocery store has a positive association with the size of household food waste across all the groupings. When the number of fast food restaurant is more than 10, the effect is positive and statistically significant at  $p < 0.003$ . The marginal effects indicated that compared to a household that has no fast food restaurant between their house and closest grocery store has 24% greater probability to be in “no food waste” category compared to the probability level of a household to that has more than 10 fast food restaurants to be in “no food waste category”. The food literacy variable, as captured by the level of confidence in using Nutrient Content Table to make healthy food choices, have a negative and statistically significant ( $p < 0.08$ ) association with household food waste volume.

We have used the same set of explanatory variables to explore whether these household characteristics are associated with different reasons for household food waste. Table 6 reported the ordered logit result for the food waste due to “buying more than required”. The results indicated that all the higher income categories relative to the excluded class of household income



less than \$ 40,000 before tax, waste food due to “buying more than required” and the association is statistically significant at 5% or lower significance levels. We found no other variable have any systematic association with the reason of “buying more than required” as a reason to waste food.

#### **INSERT TABLE 6 HERE**

The reason of “large package sizes which are too large for the respondents requirements” to waste food is explored in Table 7. The “ethical drivers” of food purchasing has a positive and statistical significant association for food waste due to large package sizes. Tthe reasons are not clear for this positive association. Food literacy levels have negative and significant ( $p < 0.001$ ) association with food waste due to “large package size”. Such association is not surprizing, given that households with higher food literacy level could plan their purchase and meal preparation to avoid food waste.

#### **INSERT TABLE 7 HERE**

The ordered logistic regression results for food waste as a result of “best before or use by date” are given in Table 8. Older respondents are less likely to waste food as a result of not used by best before or use by date than younger respondents. The strength of this association is consistently increases as age groups are indicating older age cohorts. Food literacy again have a negative and statistically significant ( $p < 0.07$ ) association between wasting food due to best before date or use by date and the level of food literacy.

#### **INSERT TABLE 8 HERE**

The association between “ethical drivers” in food purchasing and food waste due to preparing too much at mealtimes is negative and significant at the conventional levels (Table 9) indicating that consumers with higher appreciations for “ethical drivers” may be burdened by “guilt” of cooking too much and throwing away. Older age cohorts are much less likely to waste food due to the reason of preparing too much. Perhaps, this may be related to their “restrictive” diets with lesser evil foods (less fat, sugar and salt), which are prepared for older couples in the households where kids are no longer living. In this regression too, the association between food literacy and food waste as a result of preparing too much during the meal time is negative and significant. This finding supports the argument that consumer knowledge and ability to plan shopping and meal preparation is a key factor for preventing food waste.

#### **INSERT TABLE 9 HERE**

Finally, Table 10 presents the ordered logit regression for wasting food as a result of someone in the household not liking the taste of certain foods or meals. In this result too, the association between “ethical drivers” in food purchasing and food waste due to “disliking the taste” of food is negative and significant at the conventional levels (Table 10) indicating that consumers with higher appreciations for “ethical drivers” may be burdened by “guilt” of cooking and throwing away due to “pleasure” reasons. The negative association between value-seeking drivers and food waste due to “disliking the taste” is also intuitive, where frugal consumers would carefully select what they really enjoy. However, young people in the age cohort of 25 to 34 years old would throw away food as a result of “disliking the taste” more than older age cohorts for whom the association is negative, though not statistically significant. Food literacy is here again negatively and significantly ( $p < 0.001$ ) associated with the wasting of food as a result of “disliking

the taste”. One may argue that people with knowledge and ability to plan and purchase food that suit to the taste of the household are unlikely to waste food due to taste incompatibilities.

## **INSERT TABLE 10 HERE**

## **CONCLUSION AND IMPLICATION**

This research is explored whether drivers of food purchasing decisions are systematically associated with the household level food waste behaviour. We were particularly interested to investigate whether policy makers could appeal to “consumer morality” to prevent food waste by making them aware of the fact that food waste lead to nontrivial negative environmental externalities. Promise for appealing to consumer morality to avoid food waste is to some extent depends on whether there is evidence for a link between “consumer moral status” towards food and issues surrounding food production and their food waste behaviour. We find some support for this notion. Consumers who have greater appreciation for food attributes that are linked to “ethical and moral” dimensions of foods and food production processes are less likely to waste large volume of foods. The *homo moralis* among the populations could be “morally persuade” to avoid food waste if they are informed about the significant negative environmental consequences of their food waste behavior.

The “value seeking drivers” of food purchasing behavior did not have consistent association with the household level food waste behaviour. After all *homo economicus* may not be motivated to avoid food waste strictly due to “loss prevention” reasons. One potential explanation is that our food basket is relative inexpensive hence losses may be economically trivial. Some of the results of strong positive association between level of food waste and

household income level provide some credence to this argument. More importantly, what strategies would make *homo economicus* to engage in food waste reduction behaviour is not clear and worth serious research attention.

We also found that consumers with better knowledge about food and nutrition are less likely to waste large volume of foods and they appear to have realistic understanding of the common causes for food waste and modify their behaviour to avoid them. Thus, there is a significant role for consumer education and programs for improving their awareness about the factors that lead to household food waste and how to avoid such issues.

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**Table 1: Drivers of food purchasing decisions for Canadian consumers in 2011**

Food attributes	% responses for “extremely or very important when deciding what food to buy”	Likert Scale Score (5= extremely important; 4=very important; 3=somewhat important; 2=not very important; 1=not at all important)	
		Mean*	Standard Deviation
Food quality status	85.7	4.10 <sup>a</sup>	0.87
Nutritional value	76.3	3.90 <sup>b</sup>	0.94
Food safety status	72.6	3.80 <sup>b</sup>	1.11
Price	51.2	3.45 <sup>c</sup>	0.99
Impact on environment	47.9	3.36 <sup>d</sup>	1.04
Locally produced	45.1	3.29 <sup>e</sup>	1.05
Healthy Brand label	34.5	2.96 <sup>f</sup>	1.15
Endorsement by Heart and Stroke Foundation	34.8	2.95 <sup>f</sup>	1.17
Produced for Eco-friendly Label	25.0	2.70 <sup>g</sup>	1.17
Fair trade label	24.4	2.60 <sup>h</sup>	1.19
Raised Free Range label	24.5	2.60 <sup>h</sup>	1.23
Organic certification	23.5	2.50 <sup>i</sup>	1.25

(\*Means with the same superscript are not different at 5% significance level based on the Wilcoxon signed rank test)

Source: Conference Board of Canada Survey of Household 2011 November



**Table 2. Results of the Principal Component Analysis of the 12 Food Attributes**

<b>Variable</b>	<b>Factor1</b>	<b>Factor2</b>	<b>Factor3</b>	<b>Uniqueness</b>
Nutritional value	0.307	<b>0.626</b>	0.153	0.490
Price	-0.210	<b>0.545</b>	0.288	0.576
Food safety status	0.056	<b>0.703</b>	0.218	0.455
Food quality status	0.126	<b>0.758</b>	-0.025	0.409
Organic certification	<b>0.775</b>	0.062	0.216	0.349
Fair trade label	<b>0.739</b>	0.114	0.228	0.389
Raised Free Range label	<b>0.781</b>	0.095	0.129	0.365
Produced for Eco-friendly Label	<b>0.686</b>	0.140	0.397	0.353
Locally produced	<b>0.522</b>	0.489	0.038	0.487
Impact on environment	<b>0.492</b>	0.340	0.162	0.441
Healthy Brand label	0.246	0.051	<b>0.846</b>	0.222
Endorsement by Heart and Stroke Foundation	0.180	0.141	<b>0.851</b>	0.223
<b><i>Proportion of variation explained by each factor</i></b>	<b><i>0.2492</i></b>	<b><i>0.1964</i></b>	<b><i>0.1579</i></b>	

**Table 3. Mean Scores for the multi-item scales corresponding to three principle components for food attributes that capture the desirability of purchased food products**

Drivers of food purchasing decisions	Cronbach's $\alpha$	Average Multi-Item Scale value	Standard Deviation
Value-seeking drivers (Factor 2)	0.659	3.80	0.687
Health-seeking drivers (Factor 3)	0.770	2.95	1.049
Ethical drivers (Factor 1)	0.837	2.84	0.862

**Table 4. Descriptive Statistics of the variables used in the regression estimation**

<i><b>Dependent Variables</b></i>	Obs.	Mean	St.Dev	Min	Max
On average, how many grocery bags of food that you buy each week you end up throwing out? (1. None; 2. One; 3. Two; 4. Three or four; 5. Five or more)	1,128	1.47	0.826	1	5
(1. None; 2. Very little; 3. Some of it; 4. Most of it) How much of the food that you throw out is due to buying more than your household can eat or store?	1,128	1.77	0.855	1	4
How much of the food that you throw out is due to packaging sizes that are too large for your needs?	1,128	1.82	0.955	1	4
How much of the food that you throw out is due to food that is not eaten by the “best before or use by” dates?	1,128	2.04	0.917	1	4
How much of the food that you throw out is due to preparing too much at meal times?	1,128	1.83	0.849	1	4
How much of the food that you throw out is due to someone in your household not liking the taste of certain foods or meals?	1,128	1.56	0.746	1	4
<i><b>Explanatory variables</b></i>					
<b>Drivers of Food Purchasing Behaviour:</b>					
Ethical drivers (factor scores)	1,128	0	1	-2.4	3.23
Value-seeking drivers (factor scores)	1,128	0	1	-4.8	2.61
Health-seeking drivers (factor scores)	1,128	0	1	-2.6	2.34
<b>Age (excluded category between 18 and &lt; 25 years)</b>					
25 to 34	1,128	0.093	0.290	0	1
35 to 44	1,128	0.150	0.358	0	1
45 to 54	1,128	0.236	0.425	0	1
55 to 64	1,128	0.240	0.427	0	1
65 and over	1,128	0.239	0.427	0	1
MALE (excluded category female)	1,128	0.326	0.469	0	1
<b>House hold before tax income (excluded category less than \$ 40,000)</b>					
\$ 40,000 to \$ 75,000	1,128	0.304	0.460	0	1
\$ 75,000 to \$ 150,000	1,128	0.229	0.420	0	1
\$ 150,000 or more	1,128	0.055	0.228	0	1
<b>Distance to the store where most of the groceries are bought (excluded category less than 2 km)</b>					
2 to 5 km	1,128	0.350	0.477	0	1
5 to 10 km	1,128	0.1093	0.312	0	1
10 to 15 km	1,128	0.047	0.213	0	1
15 to 20 km	1,128	0.031	0.173	0	1
more than 20 km	1,128	0.034	0.183	0	1

<b>Number of fast food restaurant between home and the closest grocery store (excluded category none)</b>						
1 or 2	1,128	0.328	0.470	0	1	
3 to 5	1,128	0.272	0.445	0	1	
6 to 10	1,128	0.090	0.287	0	1	
More than 10	1,128	0.039	0.194	0	1	
<b>Food Literacy</b>						
Extremely or very confident in using Nutrient Content Table to make healthy choice (excluded category not at all confident, not very confident & somewhat confident)	1,128	0.409	0.492	0	1	

Source: Conference Board of Canada Survey of Household 2011 November

**Table 5. Ordered logit regression for household food waste in general**

<i>Dependent variable (Food waste)</i>			
(how many grocery bags of food from weekly food purchase ended up throwing out) : 1. None; 2. One; 3. Two; 4. Three or four; 5. Five or more	Coefficient	Std. Err.	t-value
<i>Explanatory variables</i>			
<b>Drivers of Food Purchasing Behaviour:</b>			
Ethical drivers (factor scores)	-0.1546**	0.061	-2.52
Value-seeking drivers (factor scores)	-0.121	0.081	-1.5
Health-seeking drivers (factor scores)	0.049	0.078	0.63
<b>Age (excluded category between 18 and &lt; 25 years)</b>			
25 to 34	0.555	0.371	1.5
35 to 44	0.093	0.341	0.27
45 to 54	-0.124	0.322	-0.38
55 to 64	-0.291	0.331	-0.88
65 and over	-0.293	0.317	-0.92
MALE (excluded category female)	-0.001	0.119	-0.01
<b>House hold before tax income (excluded category less than \$ 40,000)</b>			
\$ 40,000 to \$ 75,000	0.098	0.149	0.66
\$ 75,000 to \$ 150,000	-0.237	0.208	-1.14
\$ 150,000 or more	0.227	0.279	0.81
<b>Distance to the store where most of the groceries are bought (excluded category less than 2 km)</b>			
2 to 5 km	0.119	0.131	0.91
5 to 10 km	0.195	0.259	0.75
10 to 15 km	0.325	0.345	0.94
15 to 20 km	-0.278	0.502	-0.55
more than 20 km	0.432	0.416	1.04
<b>Number of fast food restaurant between home and the closest grocery store (excluded category none)</b>			
1 or 2	0.097	0.179	0.54
3 to 5	0.393*	0.187	2.1
6 to 10	0.269	0.232	1.16
More than 10	1.027***	0.327	3.14
<b>Extremely or very confident in using Nutrient Content Table to make healthy choice (0=not at all or not very or somewhat confident)</b>	-0.275*	0.153	-1.8
/cut1	0.833	0.378	2.2
/cut2	2.399	0.368	6.52
/cut3	3.405	0.389	8.76
/cut4	4.287	0.431	9.96

**Table 6. Ordered logit regression for reasons to waste food: buying more than required**

<i>Dependent variable (Food waste)</i>			
how much of the food waste due to buying more than your household can eat or store: 1. None; 2. Very little; 3. Some of it; 4. Most of it	Coefficient	Std. Err.	t-value
<i>Explanatory variables</i>			
<b>Drivers of Food Purchasing Behaviour:</b>			
Ethical drivers (factor scores)	-0.059	0.064	-0.91
Value-seeking drivers (factor scores)	0.024	0.057	0.41
Health-seeking drivers (factor scores)	-0.083	0.057	-1.45
<b>Age (excluded category between 18 and &lt; 25 years)</b>			
25 to 34	-0.004	0.269	-0.01
35 to 44	-0.208	0.276	-0.75
45 to 54	-0.047	0.255	-0.18
55 to 64	-0.243	0.245	-0.99
65 and over	-0.243	0.228	-1.06
MALE (excluded category female)	-0.165	0.107	-1.55
<b>House hold before tax income (excluded category less than \$ 40,000)</b>			
\$ 40,000 to \$ 75,000	0.331***	0.118	2.81
\$ 75,000 to \$ 150,000	0.432***	0.157	2.75
\$ 150,000 or more	0.500**	0.303	1.65
<b>Distance to the store where most of the groceries are bought (excluded category less than 2 km)</b>			
2 to 5 km	0.000	0.139	0.00
5 to 10 km	0.104	0.188	0.55
10 to 15 km	0.268	0.280	0.96
15 to 20 km	-0.024	0.300	-0.08
more than 20 km	-0.120	0.341	-0.35
<b>Number of fast food restaurant between home and the closest grocery store (excluded category none)</b>			
1 or 2	0.072	0.124	0.58
3 to 5	0.073	0.143	0.51
6 to 10	0.474	0.241	1.96
More than 10	-0.366	0.328	-1.12
<b>Extremely or very confident in using Nutrient Content Table to make healthy choice (0=not at all or not very or somewhat confident)</b>	-0.182	0.127	-1.43
/cut1	-0.124	0.284	-0.44
/cut2	1.487	0.280	5.31
/cut3	3.217	0.321	10.04

**Table 7. Ordered logit regression for reason to waste food: Package sizes too large**

<i>Dependent variable (Food waste)</i>			
how much of the food waste due to packaging sizes that are too large for your needs: 1. None; 2. Very little; 3. Some of it; 4. Most of it	Coefficient	Std. Err.	t-value
<i>Explanatory variables</i>			
<b>Drivers of Food Purchasing Behaviour:</b>			
Ethical drivers (factor scores)	0.135**	0.059	2.3
Value-seeking drivers (factor scores)	0.058	0.051	1.12
Health-seeking drivers (factor scores)	0.033	0.060	0.55
<b>Age (excluded category between 18 and &lt; 25 years)</b>			
25 to 34	0.081	0.245	0.33
35 to 44	-0.219	0.243	-0.9
45 to 54	-0.218	0.236	-0.92
55 to 64	-0.100	0.224	-0.45
65 and over	-0.072	0.230	-0.31
MALE (excluded category female)	0.020	0.104	0.19
<b>House hold before tax income (excluded category less than \$ 40,000)</b>			
\$ 40,000 to \$ 75,000	0.111	0.147	0.76
\$ 75,000 to \$ 150,000	0.006	0.134	0.04
\$ 150,000 or more	-0.133	0.294	-0.45
<b>Distance to the store where most of the groceries are bought (excluded category less than 2 km)</b>			
2 to 5 km	-0.114	0.122	-0.93
5 to 10 km	0.106	0.183	0.58
10 to 15 km	0.030	0.270	0.11
15 to 20 km	-0.419	0.357	-1.18
more than 20 km	-0.176	0.294	-0.6
<b>Number of fast food restaurant between home and the closest grocery store (excluded category none)</b>			
1 or 2	-0.127	0.117	-1.08
3 to 5	0.004	0.133	0.03
6 to 10	0.272	0.217	1.25
More than 10	-0.006	0.278	-0.02
<b>Extremely or very confident in using Nutrient Content Table to make healthy choice (0=not at all or not very or somewhat confident)</b>	-0.356***	0.116	-3.07
/cut1	-0.354	0.264	-1.34
/cut2	0.899	0.280	3.21
/cut3	2.275	0.280	8.12

**Table 8. Ordered logit regression for reason to waste food: Not eaten by “best before or use by” dates**

<i>Dependent variable (Food waste)</i>			
how much of the food waste due to food that is not eaten by the “best before or use by” dates: 1. None; 2. Very little; 3. Some of it; 4. Most of it	Coefficient	Std. Err.	t-value
<i>Explanatory variables</i>			
<b>Drivers of Food Purchasing Behaviour:</b>			
Ethical drivers (factor scores)	-0.067	0.060	-1.12
Value-seeking drivers (factor scores)	0.034	0.052	0.66
Health-seeking drivers (factor scores)	-0.073	0.066	-1.1
<b>Age (excluded category between 18 and &lt; 25 years)</b>			
25 to 34	-0.109	0.291	-0.37
35 to 44	-0.119	0.235	-0.51
45 to 54	-0.517**	0.260	-1.99
55 to 64	-0.516**	0.247	-2.09
65 and over	-0.845***	0.238	-3.55
MALE (excluded category female)	-0.002	0.117	-0.02
<b>House hold before tax income (excluded category less than \$ 40,000)</b>			
\$ 40,000 to \$ 75,000	0.327***	0.122	2.69
\$ 75,000 to \$ 150,000	0.289	0.174	1.66
\$ 150,000 or more	0.380	0.248	1.53
<b>Distance to the store where most of the groceries are bought (excluded category less than 2 km)</b>			
2 to 5 km	0.092	0.139	0.66
5 to 10 km	0.270	0.165	1.63
10 to 15 km	0.053	0.234	0.23
15 to 20 km	-0.145	0.290	-0.5
more than 20 km	-0.392	0.330	-1.19
<b>Number of fast food restaurant between home and the closest grocery store (excluded category none)</b>			
1 or 2	-0.093	0.140	-0.67
3 to 5	-0.006	0.145	-0.04
6 to 10	0.084	0.206	0.41
More than 10	-0.364	0.255	-1.43
<b>Extremely or very confident in using Nutrient Content Table to make healthy choice (0=not at all or not very or somewhat confident)</b>	-0.242*	0.128	-1.89
/cut1	-1.185	0.289	-4.1
/cut2	0.639	0.274	2.33
/cut3	2.077	0.270	7.71



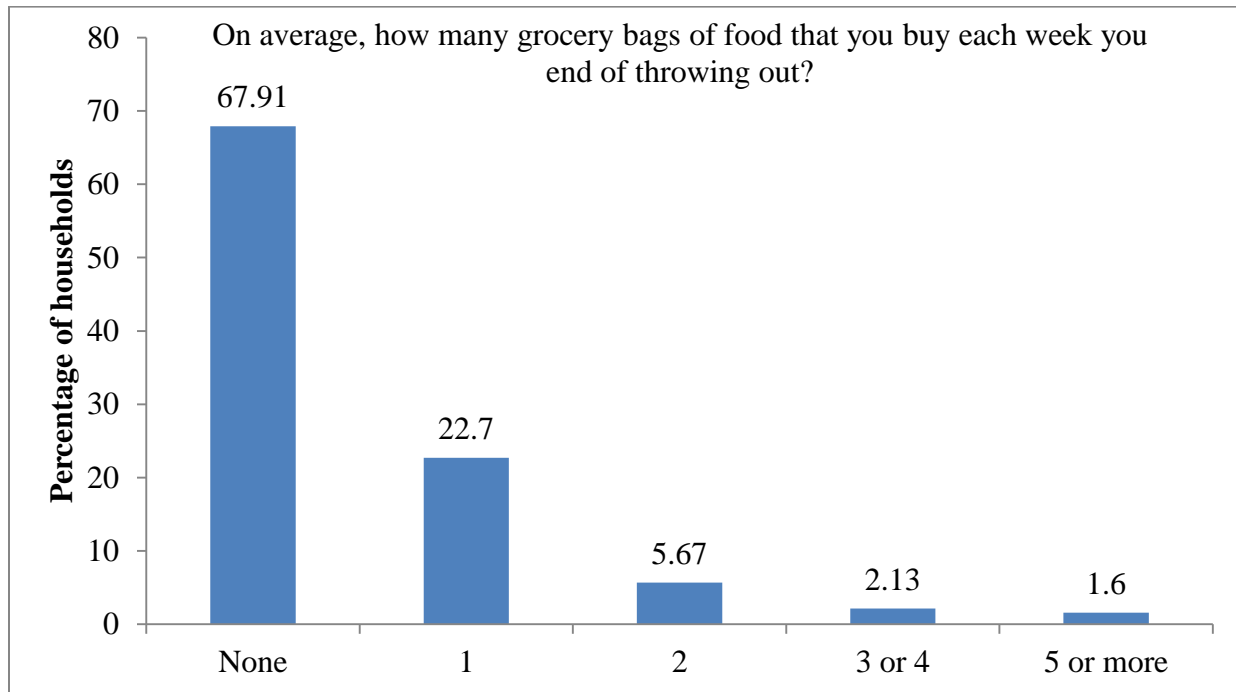
**Table 9. Ordered logit regression for reason to waste food: preparing too much at meal times**

<i>Dependent variable (Food waste)</i>			
how much of the food waste due to preparing too much at mealtimes: 1. None; 2. Very little; 3. Some of it; 4. Most of it	Coefficient	Std. Err.	t-value
<b><i>Explanatory variables</i></b>			
<b>Drivers of Food Purchasing Behaviour:</b>			
Ethical drivers (factor scores)	-0.179***	0.058	-3.09
Value-seeking drivers (factor scores)	-0.025	0.072	-0.35
Health-seeking drivers (factor scores)	-0.029	0.068	-0.42
<b>Age (excluded category between 18 and &lt; 25 years)</b>			
25 to 34	0.018	0.239	0.08
35 to 44	-0.435	0.240	-1.81
45 to 54	-0.601***	0.256	-2.35
55 to 64	-0.765***	0.234	-3.26
65 and over	-0.922***	0.231	-3.99
MALE (excluded category female)	-0.200	0.109	-1.84
<b>House hold before tax income (excluded category less than \$ 40,000)</b>			
\$ 40,000 to \$ 75,000	0.504***	0.135	3.73
\$ 75,000 to \$ 150,000	0.512***	0.141	3.64
\$ 150,000 or more	0.470	0.309	1.52
<b>Distance to the store where most of the groceries are bought (excluded category less than 2 km)</b>			
2 to 5 km	-0.087	0.124	-0.7
5 to 10 km	-0.044	0.197	-0.22
10 to 15 km	0.266	0.264	1.01
15 to 20 km	0.044	0.455	0.1
more than 20 km	-0.086	0.334	-0.26
<b>Number of fast food restaurant between home and the closest grocery store (excluded category none)</b>			
1 or 2	-0.207	0.165	-1.26
3 to 5	-0.007	0.159	-0.05
6 to 10	0.130	0.279	0.47
More than 10	-0.082	0.328	-0.25
<b>Extremely or very confident in using Nutrient Content Table to make healthy choice (0=not at all or not very or somewhat confident)</b>	-0.390***	0.134	-2.91
/cut1	-0.956	0.261	-3.67
/cut2	0.726	0.260	2.79
/cut3	2.767	0.295	9.39

**Table 10. Ordered logit regression for reason to waste food: not liking the taste**

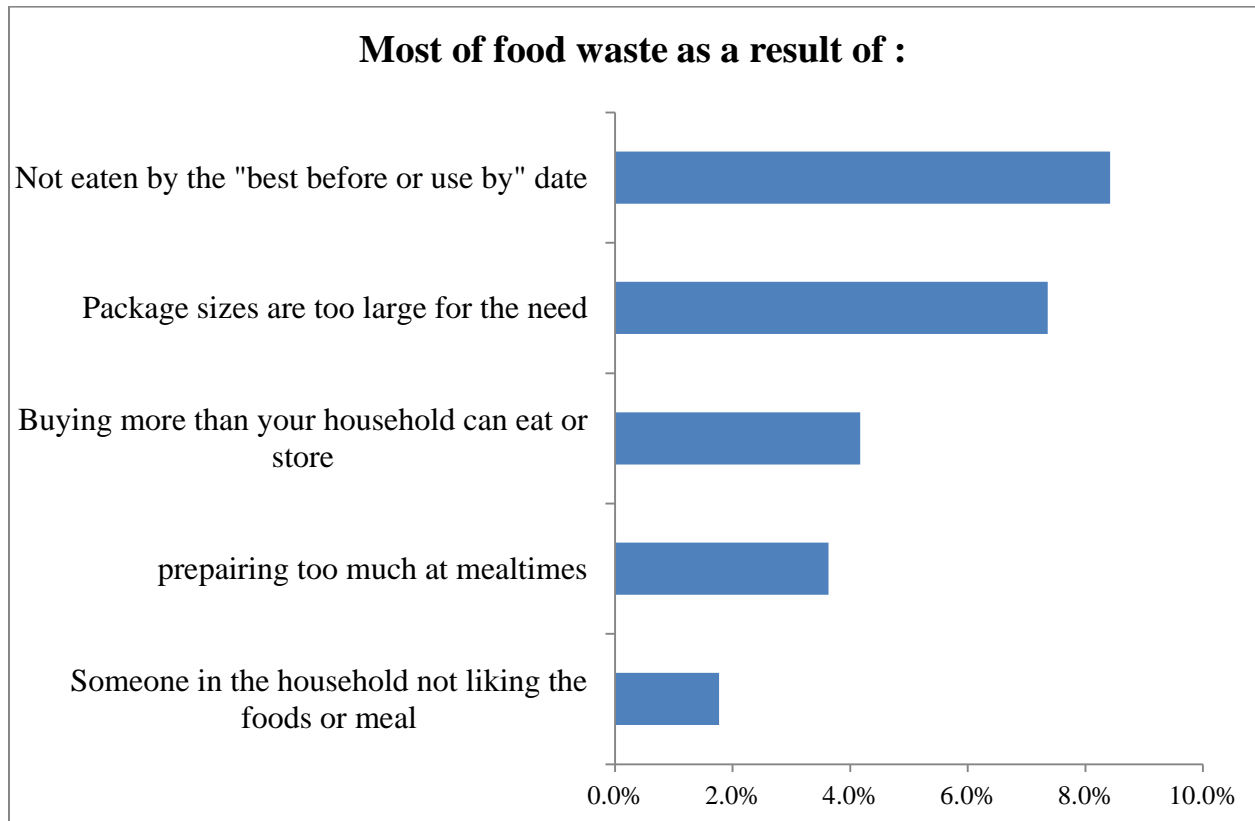
<i>Dependent variable (Food waste)</i>			
how much of the food waste due to someone is not liking the taste of food or meals: 1. None; 2. Very little; 3. Some of it; 4. Most of it	Coefficient	Std. Err.	t-value
<i>Explanatory variables</i>			
<b>Drivers of Food Purchasing Behaviour:</b>			
Ethical drivers (factor scores)	-0.212***	0.051	-4.16
Value-seeking drivers (factor scores)	-0.099*	0.061	-1.63
Health-seeking drivers (factor scores)	0.125***	0.052	2.4
<b>Age (excluded category between 18 and &lt; 25 years)</b>			
25 to 34	0.872**	0.415	2.1
35 to 44	0.457	0.365	1.25
45 to 54	-0.039	0.363	-0.11
55 to 64	-0.032	0.399	-0.08
65 and over	-0.388	0.361	-1.07
MALE (excluded category female)	-0.200	0.132	-1.51
<b>House hold before tax income (excluded category less than \$ 40,000)</b>			
\$ 40,000 to \$ 75,000	0.036	0.109	0.33
\$ 75,000 to \$ 150,000	0.245*	0.141	1.74
\$ 150,000 or more	0.355	0.265	1.34
<b>Distance to the store where most of the groceries are bought (excluded category less than 2 km)</b>			
2 to 5 km	0.188	0.130	1.45
5 to 10 km	0.142	0.175	0.81
10 to 15 km	0.191	0.287	0.66
15 to 20 km	-0.322	0.457	-0.7
more than 20 km	0.207	0.326	0.63
<b>Number of fast food restaurant between home and the closest grocery store (excluded category none)</b>			
1 or 2	0.063	0.183	0.34
3 to 5	0.199	0.185	1.08
6 to 10	0.261	0.211	1.24
More than 10	0.268	0.300	0.9
Extremely or very confident in using Nutrient Content Table to make healthy choice (0=not at all or not very or somewhat confident)	-0.366***	0.122	-3.00
/cut1	0.442	0.375	1.18
/cut2	2.205	0.383	5.76
/cut3	4.261	0.420	10.13

**Figure 1: Canadian households' food waste behaviour**



**Source:** Source: Conference Board of Canada Survey of Household 2011 November

**Figure 2 Reasons for most of food waste among the Canadian household**



**Source:** Source: Conference Board of Canada Survey of Household 2011 November