Food Waste Factors of Urban Albanian Consumers-A Multinomial Econometric Approach

Myslym Osmani, PhD
Arben Kambo, PhD
Agricultural University of Tirana, Albania

Doi: 10.19044/esj.2018.v14n3p11 URL:http://dx.doi.org/10.19044/esj.2018.v14n3p11

Abstract

Goal of this research is to improve knowledge about food waste factors in Albanian urban homes, and recommend some policies and actions on how to reduce food waste. Data collected through face-to-face interviewing of 350 urban households in Tirana city are used. The technique of multinomial logistic model and classical regression are used. A four-dimension dependent variable approach is used, to get more consistent results. Income, size of household, number of family members employed, buying food more than needed and cooking more than needed, consumer's concern about food waste, social status, shopping and post consumption habits, are some major waste factors. Odds and pattern effects of factors are varying according to levels of waste. To show commitment in relation with food waste, Albania should adopt international activities and initiatives, make legal improvements and foster education and awareness activities.

Keywords: Food waste, multinomial logit model, value discarded, waste factor

Introduction

Food losses refer to the decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption. Food losses take place at production, postharvest and processing stages in the food supply chain. Food losses occurring at the end of the food chain (retail and final consumption) are rather called "food waste", which relates to retailers' and consumers' behavior. About 1.3 billion tons of food produced in world every year is lost or wasted. More than 40% of the food losses occur at post-harvest and processing levels, while in industrialized countries, more than 40% of the food losses occur at retail and consumer level, (FAO, 2011). In terms of weight, in 2009, about 32% of food produced in the world is lost or wasted; in terms of calories, 24% of food calories produced is

lost or wasted. 53% of global loss and waste is vegetables and cereals, otherwise 63% of vegetables and cereals produced is lost or wasted. 24% of loss and waste occurs in the production phase, for which developing countries are responsible for 14% and developed countries for 10%. 35% of waste and loss occurs in the consumption phase, for which developed countries are responsible for 28% and developing countries for 7%, (Lipinski et al., 2013). Food loss and waste is today a very sensitive issue, because it is an issue of social, economic and environment character, which becomes more evident if we take into consideration the rapidly increasing population, which by 2050 will is projected to surpass 9 billion and food must be increased by 70%, (FAO, 2009).

As for Albania, it is very interesting to investigate about food waste because about 27 years ago it was under communism, and it still is among the poorest countries in Europe with an average of 3457 EUR of GDP per capita (Bank of Albania, 2015). Thus, it is for sure also a difficult endeavor to research about food waste in Albania. Because from the very beginning food waste in home might seem for some persons a pure paradox, or maybe a reality show, an illusion, a mystery, or simply a result of dummy data not being able to bring out the truth; it is very difficult for anybody to believe that poor Albanians discard away food. But, as literature has found, it may happen in poor countries however. Losses may exist in the pre-consumption phases as well of the food supply chain; because of lack of infrastructure, poor market functioning and insufficient investment in technology and knowledge, food losses might be huge.

Research problem

Previous studies have identified a number of food discard causes at consumer level, (Kambo et al., 2017a, 2017b). But the set of factors or drivers of this phenomenon, as relevant literature reveals, is much broader. Thus, there is a need to know better the factorial framework related with food waste in home. In addition, what we already know is only a general assessment of some factors influencing consumption at consumer level; but relevant factors and even their effect pattern might well be differentiated according to levels of waste. Some factors might have their own causes or factors, what will be of interest to learn as well. And the analysis of food waste could be more informative and helpful if we add to it a probabilistic dimension. The last, but not the least important is that after all for Albania is a need for a set of policy recommendation and actions, of the type as suggested by literature. It would be very helpful to Albania if it wants to actively and seriously deal with the food waste problem.

Review of literature

Food waste related research focuses mainly on identifying conditions, factors, drivers, determinants, barriers, and their types or categories, to food waste and losses, as well as formulation of recommendations and policies on how to reduce the amount of food waste and losses.

Lipinski et al., (2013), point out causes of food losses and waste in low-income countries are mainly connected to financial, managerial and technical limitations in harvesting techniques, storage and cooling facilities in difficult climatic conditions, infrastructure, packaging and marketing systems. Most losses are avoidable to some degree, and some types of waste could be almost entirely eliminated. In developing countries, investments and other measures to improve the processing, storage and transport infrastructure should address much of the problem of waste from post-harvest losses. In developed countries, possible avenues for policy action could include engaging with the private sector to increase awareness.

Segre et al., (2014) emphasize that are three types of conditions, or drivers for the food losses and waste: microeconomic (at farm and consumer level), macroeconomic, and non-economic conditions.

According to Van Geffen et al., (2016), there are three constructs of food waste factors: motivation or willingness (such as attitude, awareness and social norms); ability to prevent food waste (such as knowledge and skills); opportunity to prevent food waste (such as time and schedule, material and technologies, and infrastructure). In addition, there are distal factors (socio-demographic variables, such as age, education, gender, income, household size and composition) than exercise their influence through motivation, ability and opportunity factors. Setti et al., (2016) point out that income influences amount of waste, but different group income consumers may behave differently for different food categories.

Canali et al., (2017) emphasize that some of the more important drivers for waste are inherent characteristics of food; social and economic factors, individual non-readily changeable behaviors, priorities targeted by private and public stakeholders, diversified factors such as mismanagement and inefficient legislation, lack of awareness or information; and sub-optimal use of available technologies.

In their study Graham-Rowe, et al., (2014) arrived to the conclusion that there are two groups of motivations: waste concerns, and doing the right. Also improving management skills and empowering people to reduce waste resulted important. The authors identify also four group of barriers to waste reduction: good provider identity, minimizing inconveniences, lack of priorities, and exemption from responsibility.

Göbel et al., (2015) found that waste amount is also dependent on product group. To reduce food waste, they recommend more cooperation and

information sharing between actors along the food supply chain. Tielens et al., (2014) recommend the value chain approach improve the situation by inducing actions along all part of the chain, not only consumers. Complex and unpredictable lifestyles and job-situations are important of food waste (Göbel et al., 2012).

Silvennoinen et al.,(2014) found that foodstuffs most discarded are vegetables, home-cooked food and milk products. And the main reasons for disposing of food stuffs are spoilage: e.g. mold, expiry of best before or use by date, plate leftovers, and preparing more food than needed; examining waste per person resulted that singles generally produce more waste. Secondi et al., (2015) studied the food waste problem from the territorial and urban-rural perspective they found that urban people and people in large cities produce more waste. But these authors also found that sorting practices, education level and concern against food waste were important factors of food waste.

Purchasing decision is considered crucial in relation to food waste. (Herath et al., 2016) identify relationships between extrinsic (price, organic certification, fair trade label, free range label, eco-friendly label, heart and stroke foundation endorsement, healthy brand label) or intrinsic (nutritional value, safety, quality, impact on environment, locally produced) attributes of food, and the purchasing decision.

Ascheman et al., (2015b) point out that the consumer waste process is influenced also by some crucial trade-offs and goal conflicts, such as: health/safety versus sustainability, food safety versus environmental concern, food waste versus packaging waste, convenience or being a good food provider for the family versus avoiding food waste, etc.

According to Manalili et al., (2011), Plumb et al.,(2013), packaging is considered to be of special importance to food waste and loss, and they suggest appropriate packaging for different phases of the food chain are very important to reduce food losses and waste.

Kambo et al., (2017a, 2017b), studied the problem of food waste at consumer level for the urban area in the context Albania. They found that income, number of employed family members, size of household, immigration, zone of living, considering food stock before shopping planning, interest in the importance of the food being thrown away, feeling guilty about buying more than affect the value of food waste.

To reduce loss and waste it is extremely important working together along the supply food chain, coordination, communication and information between actors, taking responsibility about problems, causes and means of food waste reduction, UN (2009), Tielens et al., (2014), FAO (2017), Göbel et al., (2015), Asheman et al., (2015b). Expertise, knowledge and information, education programs and awareness, can help to reduce waste and losses, UN (2017), FAO (2017), Tielens et al., (2014), Herath et al., (2016),

Kambo et al., (2017b), Ascheman et al., 2015a). Inspire innovation, enable markets, support people, and build political leadership is also extremely important to achieve reduction of food losses and waste, WB (2012).

Support to famers groups and organizations would contribute to food losses reduction. This as well needs awareness and appropriate policy measures, FAO (2012). Role of good packaging policies and regulations is high, Plumb et al (2013), Manalili et al. (2011), Jörissen et al. (2015), Marangon et al. (2014), Gibon et al. (2010), and there is a need of specific pricing and food policies to reduce waste (Segre et al., 2014); in addition, specific food-reduction policies of food waste reduction are needed in urban areas (Secondi et al., 2015). Retailers can help customers reduce waste by improving freshness and quality by increasing speed through the supply chain and ensuring that food is properly handled at each stage; they can help customers not to buy too much food by offering better assortment and smaller pack sizes, and cutting back multi-buy promotions on perishable items. In the future, menu planning and shopping apps may play a role to help consumers reduce waste at their home, (Wyman, 2014).

Research goal, objectives and hypotheses

Based on the need as pointed out above, and findings of relevant research, we set as research goal improving knowledge about the factorial framework and related effects concerning food waste at consumer level.

Our research specific objectives are:

Investigate and discover pattern of effects of food waste causes, in particular learning of the pattern of effects at different levels of food waste and odds of throwing food by specific level of waste variables.

Know and understand in greater detail food waste causes and their effects.

Formulate and present a set of general policy recommendations, guidelines and actions to reduce food waste in the future.

Our research hypotheses are:

Hypothesis 1: Factors such as “educational level” of the household head, “buying food more than needed”, “cooking food more than needed”, “frequency of eating outside home”, “frequency of keeping food in the refrigerator” have a positive and significant effect on the value and mass of food waste.

Hypothesis 2: Person who is dealing with food cooking at home, whether parents or not parents, has significant but negative effect if cooking is done by parents and positive effect when cooking is done by other persons.

Hypothesis 3: Frequency of throwing food during the week is a proxy variable of food waste and is positively and significantly influenced by “buying more than needed”, “cooking more than needed”, “living zone”,

"number of employed" and "income", whereas negatively influenced by "concern" and "size of family".

Hypothesis 4: Findings of previous research on food waste factors, such as income, size of family, number of employed, concern, living zone are significant and consistent against other measures of food waste, such as value of food thrown in one day, quantity of food thrown in one week and frequency of food discard.

Use of various measures of food waste, such as "value of food wasted in one week", "value of food wasted in one day", "mass of food wasted in one week" and "frequency of throwing food" provide similar *inter alia* consistent estimates in terms of factors that influence food waste.

Method and data

Review of empirical research reveals a range of methods used by different authors. Descriptive statistics is used largely by researchers, alone or combined with other methods. Just to mention some, Graham-Rowe et al., (2014) used semi-structured interview of a number of households to investigate motivations of reducing waste in UK. Göbel et al., (2012) used experts' interview method. Secondi et al (2015) used a type of multilevel analysis to study the behavior of EU-27 countries towards waste. Canali et al., (2017) used literature review and group discussions as research methods to investigate about food waste factors. Segre et al (2014) use a proportional odds modelling procedure to identify relationship between income and food waste. Silvennoinen et al., (2014) use regression and dummy variable models to identify most discarded food categories and reasons. Regression techniques use also other authors, such as Marangon et al. (2014), Kambo et al (2017a, 2017b). We use econometric modeling to achieve the research objectives. Specifically, we use unordered logistic multinomial variable econometric modeling, and the classical econometric model. Thus, we use a combination of techniques with the aim of obtaining more reliable results.

According to the multinomial modelling method, in this research are used multinomial dependent variables. Each level of the multinomial dependent variable is considered one category of the variable and we estimate one model for each of non-reference and for the base categories of it. If first category is taken as a reference category, and the dependent variable has J categories in total, then the general form of the k-factor multinomial model is:

$$\mathbf{P_j} = \frac{\mathbf{\exp(a_j + b_{1j}X_1 + ...b_{kj}X_k)}}{\mathbf{1 + \sum_{i=2}^{J} \exp(a_i + b_{1i}X_1 + ...b_{ki}X_k)}}, \text{ for j=2, 3, J}$$

This model gives the probability or the chance of being in the ***j*** category for given values of the ***k*** factors. Another form of the above model would be:

$$\mathbf{P_j / P_1 = exp(a_j + b_{1j}X_1 + ...b_{kj}X_k)}, \text{ for j=2, 3,…,J}$$

This model gives the odds, relative chances, or the ratio of the probability of being in the category ***j*** with the probability of being in the base category. Exponentiated coefficients expo(b_i) indicate how many times are increased the odds if a specific independent variable X is increased by one unit the other X's remaining constant. Odds are greater than one (or increasing) if the regression coefficients are positive, one (constant) if the coefficient is zero, and less than one (decreasing) if the regression coefficients are negative. A third form of the model could be:

$$\mathbf{log(P_j / P_1) = a_j + b_{1j}X_1 + ...b_{kj}X_k} \text{ for j=2, 3,…,J}$$

The coefficients of this model indicate the percentage by which change the odds if a specific X is increased by one and other factors remain constant. The unordered multinomial model doesn't assume proportionality of odds. It is used MLE (Maximum Likelihood Estimator) method to obtain estimates of the coefficients. We also use the k-factor classical regression model:

$$\mathbf{Y = b_0 + b_1X_1 + ...b_kX_k + e}$$

In this model the coefficients $\mathbf{b_i}$ indicate marginal increases of Y when a specific factor $\mathbf{X_i}$ is increased by one unit, the other factors remaining constant. In all models the signs of coefficients $\mathbf{b_i}$ indicate the type expected effect of $\mathbf{X_i}$ on **Y**, whether it is positive or negative. It is used LSE (Least Squares Estimator) method to obtain estimates of the classical regression coefficients. More technical details on all kinds of models we used, the reader can find in literature, Wooldridge (2013), Gujarati (2003), Heij et al., (2004).

Data were collected through face-to-face interviewing in the city of Tirana. The number of respondent was 350. We collected data about two types of variables, quantitative and nominal; some nominal data we collected through a Likert scale. In the present study it is used an integrated three-variables multinomial approach: "value of food discarded in one week", "value of food discarded per day" and "quantity of food discarded in one week". Data about the second variable (value of food discarded per day) are obtained by an independent control question aiming at assessing the reliability of data obtained for the variable value of food discarded in one week. We asked two separate and independent questions, to get data about the two above variables. By doing so, the second variable helps to understand whether information obtained by the first questions is consistent or not. We run regression techniques using both variables in turn as dependent variables and since results we obtained are very similar (but not identical) we be more confident on these results. In addition, we used an instrumental, or proxy dependent variable for food waste, "frequency of food discard", to obtain more consistent results about factors of food waste and their effects. All variables for which data were collected and their measurement scale and units are summarized in Table 1.

Table 1: Variables, their measurement scale and units of measure

-Age, (years) **-Education** Low=1, Middle=2, High=3, Post-university=4 **-Type of house** 2=Private house, 1=Private apartment, 0=Other **-Living zone** 2=Block area, 1=New Tirana area, 0=Other **-Size of family** 1,2,3,4 above 4 (6) **-Emigration** 1=If yeas, 0=if no **-Number of emigrants** **-Number of employed** **-Income**, (000) ALL[1] **-Concern** 0= None, 1=Little 2=Too much **-Buying more than needed** 0=Don't agree, 1=Somewhat agree, 2=Agree, 3=Totally agree **-Cooking more than needed**: 0=Don't agree, 1=Somewhat agree, 2=Agree, 3=Totally agree	**-Value discarded in one week,** ALL **-% discarded in one week** **-Quantity discarded in one week**, g **-Frequency of keeping in the refrigerator**: 0=No, 1=Rarely, 2=Frequently, 3=More than frequently, 4=Always **-Frequency of eating outside house**: 0=None, 1=once a week, 2=Twice a week, 3=3-4 times a week, 4=5-7 times a week **-Frequency of discard bread and sweets**: 0=No, 1=Rarely, 2=Frequently, 3=More than frequently, 4=Always **-Frequency of discard cooked food**: 0=No, 1=Rarely, 2=Frequently, 3=More than frequently, 4=Always **-Frequency of discard potatoes**: 0=No, 1=Rarely, 2=Frequently, 3=More than frequently, 4=Always **-Frequency of discard milk and milk byproducts** 0=No,1=Rarely, 2=Frequently, 3=More than frequently, 4=Always	**-Frequency of discard meat and fish**: 0=No, 1=Rarely, 2=Frequently, 3=More than frequently, 4=Always **-Frequency of discard pasta** 0=No, 1=Rarely, 2=Frequently, 3=More than frequently, 4=Always **-Frequency of discard fruits and vegetables**: 0=No, 1=Rarely, 2=Frequently, 3=More than frequently, 4=Always **-Frequency of discard rice**: 0=No, 1=Rarely, 2=Frequently, 3=More than frequently, 4=Always **-Mean frequency of food discard** **-Value discarded in one week** (ALL), Up to 500, 500-1000, 1000-1500, Above 1500, multinomial **-Value discarded per day** (ALL): 50, 100, 200, Above 300, multinomial **-Quantity discarded per week** g, multinomial Up to 500, 500-1000, Above 1000 **-Who does cooking** 1=Parents, 0=Other

Results

First, we estimated a model where as a dependent variable is the value of food discarded by consumers in one week. The estimation results are shown in Table 2. Data in the table reveal that: the variables with positive effect on the value of food discarded in one week are buy more than needed, number of family members, zone where people live with consumers in the block area tending to discard more food, type of dwelling where consumers with private dwelling tending to discard more food away, and family income. Another result is that older respondents tend to report more waste.

Table 2: Multinomial logit model, dependent variable "value discarded per week", base category= Up to 500 ALL

	Coefficient	p-value	Sign.	Expo(B)
500-1000 ALL				
Constant	-1.93965	0.01372	**	0.143754

[1] ALL is Albanian National Currency (Lek)

Emigration	-1.01161	0.00196	***	0.363633
Buy more than needed	0.297774	0.03543	**	1.346857
Living zone	0.436389	0.05293	*	1.547111
Income	7.87216e-06	0.01744	**	1.000008
Concern	-0.143909	0.63386		0.865967
Age	0.0112428	0.27653		1.011306
Type of house	0.201244	0.28976		1.222923
Size of family	0.090395	0.38034		1.094607
1000-1500 ALL				
Constant	-2.63436	0.00594	***	0.071765
Emigration	-1.05885	0.02202	**	0.346854
Buy more than needed	0.731427	0.00030	***	2.078044
Living zone	0.568388	0.03702	**	1.765419
Income	1.23283e-05	0.00098	***	1.000012
Concern	-0.822834	0.02097	**	0.439185
Age	0.0209076	0.14402		1.021128
Type of house	0.222812	0.40073		1.249586
Size of family	-0.104958	0.45364		0.900362
Above 1500 ALL				
Constant	-1.26151	0.30186		0.283226
Emigration	-0.264415	0.66316		0.767655
Buy more than needed	0.76144	0.00959	***	2.141358
Living zone	0.332379	0.37840		1.394281
Income	1.58842e-05	0.00132	***	1.000016
Concern	-0.913552	0.05405	*	0.401097
Age	-0.040376	0.08259	*	0.960428
Type of house	0.865855	0.02601	**	2.377038
Size of family	-0.432184	0.03026	**	0.64909

Note: (*) Significance at 10%, (**) Significance level at 5%, (***). Significance level at 1%.

Variables having a negative effect are emigration and concern about food waste. Variables mentioned above as having effect on value of waste, do not seem to have effect across all categories; living zone and emigration don't seem to factors of waste in the high food discarded category of consumers; while type of dwelling seems to affect food waste only in the lower value categories of food wasters. Concern about waste doesn't seem to affect food waste in lower category of food waste. Only income and buying more than needed seem to have effect on food waste across all categories of food wasters.

Living zone and buy more than needed have the highest odds across all categories and type of dwelling in the last category of food waste. Thus, if consumers move to a better living zone the odds of wasting more are 1.3 higher when they are in the second category of food waste, 2.07 times higher when they are in the third waste category, and 2.1 times higher if they are in the last waste category in respect to base category, which is the lowest. And if the consumers of the last category move to a private house, then it is expected that

the odds of being in the last category of waste against being in the base category increase by 2.037 times.

In a similar way the reader could read other similar information of the Table 2 for other variables and categories of food waste.

We performed the same analysis by changing the dependent variable; this time we used as dependent the quantity of food discarded. The estimated model is shown in Table 3 below:

Table 3: Multinomial logit model, dependent variable "quantity discarded per week", base category= Up to 500 g

	Coefficient	p-value	Sign.	Expo(B)
500-1000 g				
Constant	-3.27168	<0.00001	***	0.037943
Emigration	-0.445612	0.16176		0.640432
Buy more than needed	0.009556	0.95112		1.009603
Cook more than needed	0.608232	0.00025	***	1.83718
Type of house	0.205886	0.29425		1.228613
Size of family	0.182148	0.07082	*	1.199792
Income	8.820e-06	0.00066	***	1.000009
Above 1000 g				
Constant	-6.93721	<0.00001	***	0.000971
Emigration	-0.89952	0.06543	*	0.406765
Buy more than needed	0.428634	0.06259	*	1.535159
Cook more than needed	0.528659	0.02688	**	1.696656
Type of house	0.711891	0.02531	**	2.037841
Size of family	0.399615	0.00527	***	1.49125
Income	1.552e-05	<0.00001	***	1.000016

From the Table 3 we can easily identify that factors behind waste remain almost the same, with little change; living zone and concern about food waste are no more factors of food waste if this is meant as quantity or mass of waste. And cooking more than needed, results very powerful and positively significant. Again, we have a negative effect of emigration, and positive effects of the family members, income, private house or apartment. In terms of odds, we could identify as an illustration that type of house and cooking more than needed have very high odds. Thus, odds of cook more than needed are 1.8, meaning that chances of discarding 500-1000 g per week increase by 1.8 times as compared to discarding up to 500 g (base category), if buy more than is rated one unit more. And odds of cooking more than needed are 1.69 for the category above 1000 g, meaning that chances of discarding above 1000 g per week increase by 1.69 times as compared to discarding up to 500 g (base category), if buy more than is rated one unit more. And the odds are decreasing if we compare the above 1000 category with 500-1000 category

(1.697/1.834=0.93). Odds of income are quite constant, for any category of the dependent variable.

We repeated the analysis by changing again the dependent variable. This time we have the value discarded per day as a dependent. The estimated model is shown in Table 4:

Table 4: Multinomial logit model, dependent variable "value discarded per day", base category=50 ALL

	Coefficient	**p-value**	**Sign.**	**Expo(B)**
100 ALL				
Constant	-1.241	0.07704	*	0.289095
Buy more than needed	0.339759	0.02450	**	1.404609
Cook more than needed	0.0985438	0.52250		1.103563
Type of house	0.024207	0.89405		1.024502
Living zone	0.405652	0.06451	*	1.50028
Income	6.2030e-06	0.04701	**	1.000006
Concern	-0.16838	0.55239		0.845033
Size of family	0.00748852	0.93727		1.007517
200 ALL				
Constant	-3.80789	0.00015	***	0.022195
Buy more than needed	0.304223	0.13500		1.355571
Cook more than needed	0.615732	0.00581	***	1.851011
Type of house	0.614567	0.02666	**	1.848856
Living zone	0.734516	0.00613	***	2.084473
Income	1.2545e-05	0.00058	***	1.000013
Concern	-0.0474021	0.90266		0.953704
Size of family	-0.249314	0.06713	*	0.779335
300 and above ALL				
Constant	-2.84205	0.02514	**	0.058306
Buy more than needed	1.17908	0.00131	***	3.251382
Cook more than needed	-0.098743	0.76309		0.905976
Type of house	0.398263	0.32062		1.489236
Living zone	0.45704	0.23307		1.579392
Income	1.3481e-05	0.00399	***	1.000013
Concern	-1.18483	0.01178	**	0.305798
Size of family	-0.338867	0.09444	*	0.712577

Again, income, living zone, buying more than needed, number of family members, private house or apartment, have a significant positive effect on the value of food discarded. In this case disappears cooking more than needed and emigration as factors of waste. By combining results from the three groups we could identify a more consolidated and at the same time more expanded list of factors that do affect significantly waste of food. In case we would have used only the first dependent variable, value of food discarded per week, we could not have identified cooking too much as a factor of waste; in the case of mass of waste as a dependent we couldn't identify concern about waste as a factor, and if we had used only the third variable as dependent we could not identify emigration and cooking more than needed as factors of food

waste. It seems clear that buying more than needed, type of house and living zone have high (increasing) odds, while concern has decreasing odds. The latter means that for all categories of food discarded, there is a negative relationship between level of concern and value of food discarded per day. In other words, if we were in category "300 or above", a unit increase in concern is associated with 69% decrease in value of food discarded, (100-0.3057*100) =69). Being the odds of the lower category (200 ALL) higher means that odds of value discarded per day are deteriorating with increasing value. Buying more than needed was shown to be an important variable taking to more waste. To investigate about factors which influence the consumer behavior in respect to cooking more than needed we used a multinomial approach. The results of estimation are presented in table 5 below:

Table 5: Multinomial logit model, dependent variable "buying more than needed", base category= Don't agree

	Coefficient	**p-value**	**Sign.**	**Expo(B)**
Somewhat agree				
Constant	-0.155768	0.82730		0.855758
Cook more than needed	0.420885	0.06567	*	1.523309
Who does cooking	-0.016253	0.97057		0.983878
Education	0.265412	0.26442		1.303968
Living zone	-0.219028	0.45149		0.803299
Agree				
Constant	-1.175800	0.11742		0.308572
Cook more than needed	0.943432	0.00006	***	2.568782
Who does cooking	-0.340892	0.44026		0.711136
Education	0.401654	0.09970	*	1.494294
Living zone	0.013685	0.96187		1.01378
Totally agree				
Constant	-3.11146	0.00043	***	0.044536
Cook more than needed	1.626300	<0.00001	***	5.085025
Who does cooking	-1.00262	0.03464	**	0.366917
Education	0.725700	0.00760	***	2.066177
Living zone	-0.499482	0.11493		0.606845

Buying more than needed is explained by cooking more than needed, in the sense that who intends to cook more is expected also to buy more food, across all categories of the variable buy more than needed. Other variables affecting the quantity of cooking seem to be education, living zone and person who is making cooking in house. When coking is done by parents, the quantity of buying is less and if education is higher, then tendency is to buy more than needed. But, as previously explained, differences exist between categories of the variable buy more than needed and not all factors have significant effects across all categories (for example living zone).

One could notice very high and increasing odds of cooking too much from lowest to highest categories of the dependent variable. Just to illustrate

this, odds of buying more than needed for the category of households that agree totally that cooking more than needed is the factor explaining why buy more than needed, is roughly 5 (more exactly 5.08); thus, if the factor cook more than needed in this category is increased by one unit, chances of buying more than needed in this category increase by 5 times as compared to chances of buying in the base category. It would be interesting to investigate about the factors behind cooking too much variable.

We estimated a logistic multinomial model and found that buying too much is significant (Table 7).

Table 7: Multinomial logit model, dependent variable "cooking more than needed", base category= Don't agree

	Coefficient	**p-value**	**Sign**	**Expo(B)**
Somewhat agree				
Constant	0.899302	0.06053	*	2.457887
Who does cooking	-0.352977	0.44169		0.702593
Buy more than needed	0.427237	0.08464	*	1.533016
Agree				
Constant	-0.414961	0.42786		0.660366
Who does cooking	0.434883	0.35770		1.544782
Buy more than needed	1.060960	0.00003	***	2.889143
Totally agree				
Constant	-1.72088	0.00452	***	0.178909
Who does cooking	0.332589	0.50528		1.394574
Buy more than needed	1.566370	<0.00001	***	4.789232

Thus, more cooking is going to take place if family buys more than needed. So, between buying more and cooking more than needed seems to be a two-direction relationship. Next, we investigated about factors affecting consumers' concern about waste. It seems to be only income to have a significant and negative effect on this (Table 8).

Table 8: Multinomial logit model, dependent variable "concern about food waste", base category=None

	Coefficient	**p-value**	**Sign.**	**Expo(B)**
Little				
Constant	2.67899	0.00005	***	14.57037
Income	-3.02368e-06	0.51720		0.999997
Too much				
Constant	4.33581	<0.00001	***	76.38681
Income	-8.01091e-06	0.07983	*	0.999992

It might seem like a paradox that high income families tend to have less concern about food waste and may be this category of consumers should be major focus of food waste reduction awareness activities and policies. In addition, we see that odds of concern with increased income are quite constant (Expo(B)=0.9999) for both little and too much levels of concern.

A positive effect is found of the frequency of eating outside on the value of food discarded; and this is a universal finding for all categories of food wasters, that households who go out for meals more frequently tend to discard more food, (Table 9). A number of hypothesis could be set up here but it is not the aim of this study to go further. In addition, we can identify easily that odds of the value of discard for households that eat outside and are in the top level of food value discarded as much as 2.2168 higher compared to households that eat outside by belong to the base category of value discarded. If we want to calculate this in comparison to the (500-1000) level, we divide odds of eating outside for both levels we get a result 1.8 times higher (2.2168/1.234=1.8).

Table 9: Multinomial logit model, dependent variable "value of food discarded", base category= Up to 500 ALL

	Coefficient	**p-value**	**Sign.**	**Expo (B)**
500-1000 ALL				
Constant	-0.42738	0.02920	**	0.652216
Frequency of eating outside	0.210294	0.06957	*	1.234041
1000-1500 ALL				
Constant	-1.88214	<0.00001	***	0.152264
Frequency of eating outside	0.595599	0.00004	***	1.814117
Above 1500 ALL				
Constant	-3.17948	<0.00001	***	0.041607
Frequency of eating outside	0.796054	0.00009	***	2.216776

We expand our analysis by considering the variable frequency of food discard as proxy variable for the dependent value and amount of the food discarded. Thus, another important aspect of our research is investigation about factors that influence frequency of food discard for major food categories. In this case, the frequency of discard could be considered a proxy (indirect) variable for the quantity or value of food discarded.

We carried this for major categories of food: fruits and vegetables, cooked food, milk and milk-based food, meat including fish, pasta, rice, bread and sweets. Because of limited place, in this paper we present analytically results for fruits and vegetables only. For other categories we present only some general findings. Tables 10 presents the results of econometric modeling for fruits and vegetables.

Looking by table rows we've found that various factors can have an influence but not statistically significant for all levels of food discard. And effects vary according to its levels. If we look at "rarely" category or level, only concern is statistically significant, and concern is not significant for the "frequently" and "more than frequently" categories. Income is statistically significant for all categories except for "rarely" levels.

Table 10: Multinomial logit model, dependent variable "frequency of discarding" ffruits and vegetables, base category: No discard

	Coefficient	p-value	Sign.	Expo(B)
Rarely				
Constant	−0.639231	0.4948		0.53
Number of employed	−0.148617	0.5512		0.86
Income	3.26106e-06	0.5342		1.00
Concern	0.973714	0.0125	**	2.65
Buying more than needed	0.150802	0.4669		1.16
Frequently				1.00
Constant	−0.642817	0.4822		0.53
Number of employed	−0.229740	0.3651		0.79
Income	1.06009e-05	0.0352	**	1.00
Concern	0.565745	0.1297		1.76
Buying more than needed	0.327030	0.1206		1.39
More than frequently				1.00
Constant	−2.30124	0.0295	**	0.10
Number of employed	0.163197	0.5659		1.18
Income	1.22619e-05	0.0205	**	1.00
Concern	−0.146155	0.7284		0.86
Buying more than	0.791841	0.0025	***	2.21
Always				1.00
Constant	−9.88000	<0.0001	***	0.00
Number of employed	0.609501	0.0805	*	1.84
Income	1.66695e-05	0.0052	***	1.00
Concern	2.14415	0.0497	**	8.53
Buying more than needed	1.10063	0.0082	***	3.01

Buying more than needed is significant for the two last levels of frequency. Number of employed is significant only for the last level of the dependent variable. If we focus now on odds, we see rapidly increasing odds for the variable "concern", then for variable "buying more than needed". Thus, if concern in the always level of frequency increases by one unit, odds of being in this level are about 8.5 times higher than in the "no discard" level of frequency. this means that higher levels of frequency of food throw (vegetables and fruits) are associated with higher level of concern. We see constant odds for income for all levels of the frequency. This means that with respect to income, the probability of a consumer being in one of five categories of the frequency is almost the same, otherwise income is almost equally important for all consumers regardless of how much frequently they throw away vegetables and fruits.

Based on results we obtained through econometric modeling for other food categories (not presented here), some other findings are: for the category of frequency "rarely", living zone seems to have a positive influence only on the frequency of food discard for milk or milk-based food only; number of employed per family is expected to influence only frequency of discard of meat

and milk base food; buying more than needed is expected to influence also frequency of discard of meat, milk, pasta, potatoes, breads and sweets; cooking more than needed is expected to influence pasta and potatoes; income is a very significant factor for families that discard rice-based food also; for the meat food category, we identified that size family, number of employed and buying more than needed seem to be the most influencing factors for some categories of the frequency variable; for the milk-based food the most important factors seem to be buying more than needed, living zone and size of family.

And lastly, in order to have a general assessment of which is influencing in food discard frequency regardless of its levels, we estimated a classical linear model in which frequency of discard is taken as dependent variable. Frequency of discard is measured as a mean frequency of discard for all categories of food, so the mean frequency is not a multinomial variable (Table 11).

Table 11: Dependent variable "average of frequency of discard", all types of products

	Coefficient	**p-value**	**Sign.**
Constant	0.783994	<0.00001	***
Buy more than needed	0.168869	<0.00001	***
Concern	-0.111130	0.08928	*
Cook more than needed	0.0775531	0.03706	**
Living zone	0.0925955	0.06388	*
Size of family	-0.0466609	0.03779	**
Number of employed	0.1161450	0.00417	***
Income	1.775e-06	0.00714	***

Factors that statistically and negatively influence the frequency of the food discarded are concern about food waste and size of family; positive effects have buying more than needed, cooking more than needed, income, living zone, and number of employed persons in the family. Thus, if level of concern is increased by one unit then a decrease of the frequency is expected by 0.11 units, other factors remaining constant. If level of buying more than needed is increased by one unit then an increase in frequency of discard is increased by 0.169 units approximately.

Discussion

Our study confirms main literature findings on food waste factors in the Albanian context, such as household income, education level, concern about the importance and consequences of discarding food, size and type of household, and buying habits. In particular, it reaffirms findings of previous studies done for Albania about major food waste factors, such as Income, location of house or residence, emigration, size of family, concern, and number of employed members in a family.

In general, the research contributes to improving knowledge about in-home food waste factors, with new findings about food waste factors at

consumer level in Albania, and their effect pattern. In this regard it reveals that other factors, like buying more than needed and cooking more than needed, type of house and who does cooking are additional important factors. All the research hypotheses formulated hold true.

Conclusion

The study reveals that variable "Buying more than needed" itself has its own factors, such as cooking more than needed, education, who does cooking and the living zone. Cooking more than needed is inter-related with buying more than needed and is also affected by who does cooking.

Consumer concern is a variable that seems to negatively influenced by level of household income. And value of food discarded is negatively related with the frequency of eating outside.

Our multinomial approach gave the possibility to reveal the effect pattern not just in general, but in greater detail, looking at the effects by levels or categories of food waste.

Thus, value of food discarded per week is related to concern but only in its higher categories; it is related to type of house, but only for the highest category; it is related to emigration, but not for the highest category; it is related to buying more than needed for all its categories, but with increasing odds; it is related with income, but with almost constant odds. It is influenced by living zone, but for lower categories; by size and type of house, but for only the highest category of waste (with increasing odds for type of house and decreasing odds for size of family as compared to the base category.

Cooking more than needed is dependent on buying more than needed for all categories of consumers, but with increasing significance and odds for consumers who support buying more as a factor for cooking more.

Buying more than needed for all its categories seem to be related to cooking more than needed, but with increasing significance and odds for higher categories. Buying more than needed seems, but only for its higher category, related with education, and with who does cooking but only for its higher (totally agree) category. Level of concern is depended on income, but only when concern category is too much.

Frequency of discard (proxy of food waste) is dependent on income, concern, number of employed, cook more than needed, buy more than needed, size of family, living zone.

Value of food discarded at all its levels is dependent on frequency of eating outside.

Recommendations

Albania should carry out a comprehensive study about the level and reasons, alongside the food supply chain and by product type, of food waste at

national level. Then, establish a system for data collection and publication at regular basis about food losses and waste in Albania, in line with EU relevant standards and policies. Investigations are needed to reveal of regional, urban-rural and among-social-strata differences about food waste factors, levels and patterns, based on a broader scope and database. In addition, role of other factors on food waste as indicated by literature and research, such as packaging, social status, beliefs, consumer information, knowledge, motivations and skills; food quality and safety, fair trade label, free range label, eco-friendly label, healthy brand label, locally produced, processing and distribution related factors, etc., should be investigated, to obtain a broader context, or framework of factors or barriers to food waste.

References:

1. Aschemann, J., Witzel, I. de H., Amani, P., Bech-Larsen, T., Gustavsson, J. (2015a). Consumers and food waste – a review of research approaches and findings on point of purchase and in-household consumer behavior, Paper prepared for presentation at the EAAE-AAEA Joint Seminar 'Consumer Behavior in a Changing World: Food, Culture, Society", Naples, Italy, 2015
2. Aschemann, J., Witzel, I. de H., Amani, P., Bech-Larsen, T., Oostindjer, M. (2015b). Consumer-Related Food Waste: Causes and Potential for Action, Sustainability 2015, 7, 6457-6477; doi:10.3390/su7066457
3. Bank of Albania, Annual Report 2015, p. 30
4. Canali, M., Amani, P., Aramyan, L., Gheoldus, M., Moates, G., Östergren, K., Silvennoinen, K., Waldron, K., Vittuari, M. (2017). Food Waste Drivers in Europe, from Identification to Possible Interventions, Sustainability 2017, 9, 37; doi:10.3390/su9010037
5. FAO (2009). How to Feed the World in 2050, www.fao.org/fileadmin/.../How_to_Feed_the_World_in_2050.pdf
6. FAO (2011). Food Waste: Causes, Effects, and Solutions, Study conducted for the International Congress, Save Food! at Interpack2011 Düsseldorf, Germany, FAO 2011
7. FAO (2012). The role of producer organizations in reducing food loss and waste. www.fao.org/docrep/016/ap409e/ap409e.pdf
8. FAO (2017). Save Food: Global Initiative on Food Loss and Waste Reduction: Key facts on food loss and waste, http://www.fao.org/save-food/resources/keyfindings/en/
9. Göbel, C.; Teitscheid, P.; Ritter, G.; Blumenthal, A.; Friedric, S.; Frick, T.; Grostollen, L.; Möllenbeck, C.; Rottstegge, L.; Pfeiffer, C.; et al (2012). Verringerung von Lebensmittelabfällen– Identifikation von Ursachen und Handlungsoptionen in Nordrhein-

Westfalen; FachhochschuleMünster—InstitutfürNachhaltigeErnährung und Ernährungswissenschaft (iSuN): Münster, Germany, 2012

10. Göbel, C.; Langen, N.; Blumenthal, A.; Teitscheid, P.; Ritter, G. (2015). Cutting Food Waste through Cooperation along the Food Supply Chain, Sustainability 2015, 7, 1429–1445.
11. Graham-Rowe, E., Jessop, D.C., Sparks, P. (2014). Identifying Motivations and Barriers to Minimising Household Food Waste. Resources Conservation and Recycling, 2014, 84, 15–23
12. Gujarati, D. (2003). Basic Econometrics, 4th edition, 2003, pp 580-624
13. Herath, D., Felfel, A. (2016). Determinants of consumer food waste behavior: Homo Economicus vs. Homo Moralis, Selected Paper prepared for presentation at the 2016 Agriculture and Applied Economics Association Annual Meetings, Boston, Massachusetts, July 31-August 2
14. Heij, Ch., De Boer, P., Franses, Ph.H.,Kloek, T., Van Dijk, H.K. (2004). Econometric Methods with Applications in Business and Economics, Oxford University Press, 2004, pp 437-523
15. Jörissen, J., Priefer, C., Bräutigam, K-R. (2015). Food Waste Generation at Household Level: Results of a Survey among Employees of Two European Research Centers in Italy and Germany, Sustainability 2015, 7, 2695-2715; doi:10.3390/su7032695, ISSN 2071-1050
16. Kambo, A., Keco, R., Tomorri, I. (2017). An empirical Investigation of the Determinants of Food Waste Generation in urban Area at Household Level in Albania, IJECM Vol. V, Issue 5, May 2017 ISSN 2348 0386
17. Kambo, A., Keco, R., Tomorri, I. (2017). Pre-shopping activities and their influence on amount of food waste generated at household level in urban area of Albania: an econometric approach, IJECM, Vol. V, Issue 6, June 2017, ISSN 2348 0386
18. Lipinski, B., Hanson, C., Lomax, J., Kitinoja, L.,Waite, R., Searchinger, T. (2013). Reducing Food Loss and Waste, Installment 2 of "Creating a Sustainable Food Future", UNEP, World Resource institute, Working Paper | June 2013
19. Manalili, N.M., Dorado, M.A., Van Otterdijk, R. (2011). Appropriate food packaging solutions for developing countries, Study conducted for the International Congress SAVE FOOD! at Interpack 2011 Düsseldorf, Germany (FAO, Rome)

20. Plumb, A., Downing, Ph. (2013). Consumer Attitudes to Food Waste and Food Packaging, Research carried out by Icaro Consulting, WRAP Final Report, ISBN: 978-1-84405-465-7, 2013
21. Secondi, L., Principato, L., Laureti, T. (2015). Household food waste behavior in EU-27 countries: A multilevel analysis, Elsevier, Food Policy, Vol.56 October 2015, p 25-40, https://doi.org/10.1016/j.foodpol.2015.07.007
22. Segrè A., Falasconi L., Politano A., Vittuari, M.(2014).Background paper on the economics of food loss and waste, FAO Working Paper 2014
23. Setti, M. Falasconi, L., Segrè, A., Cusano, A., Vittuari, M. (2016). Italian consumers' income and food waste behavior, British Food Journal, Vol. 118 Issue: 7, (2016), pp.1731-1746, https://doi.org/10.1108/BFJ-11-2015-0427
24. Silvennoinen, K. Juha-Matti, K., Hanna, H., Lotta, H., Reinikainen, A., (2014),"Food waste volume and composition in Finnish households", British Food Journal, Vol. 116 Iss 6 pp. 1058 - 1068 Permanent link to this document: http://dx.doi.org/10.1108/BFJ-12-2012-0311
25. Tielens, J., Candel, J. (2014). Reducing food wastage, improving food security? An inventory study on stakeholders' perspectives and the current state of knowledge on the relationship between reducing food wastage, and improving food security, Commissioned by: Food & Business Knowledge Platform, knowledge4food.net/wp-content/.../2014/.../140702_fbkp_report-foodwastage_DEF
26. Van Geffen, L.E.J., E. Van Herpen and J.C.M. van Trijp 2016: 'Causes & Determinants of Consumers Food Waste. Project Report', EU Horizon 2020 REFRESH. Wageningen, The Netherlands: Wageningen University and Research, 44 pp.
27. Visschers, V.H.M., Wickli, N., Siegrist, M. (2015).Sorting out food waste behavior: A survey on the motivators and barriers of self-reported amounts of food waste in households, https://doi.org/10.1016/j.jenvp.2015.11.007
28. Wooldridge, J.W. (2013). Introductory Econometrics, fifth edition, 2013, South-Western Cengage Learning, pp 225-251