Available online at www.centmapress.org

INTERNATIONAL JOURNAL ON FOOD SYSTEM DYNAMICS

Int. J. Food System Dynamics 11 (4), 2020, 387-401

DOI: http://dx.doi.org/10.18461/ijfsd.v11i4.62

Factors Influencing Consumers' Perceptions of Safety Risk of Fresh Domestic Tomato in Albania-a Multinomial Econometric Approach

Myslym Osmani[1], Remzi Keco[2], Arben Kambo[1], and Ilir Tomorri[2]

[1]*Department of Economics and Rural Development Policy, Faculty of Economy and Agribusiness, Agricultural University of Tirana, Tirana, Albania*
[2]*Department of Agribusiness Management, Faculty of Economy and Agribusiness, Agricultural University of Tirana, Tirana, Albania*
mosmani@ubt.edu.

Received November 2019, accepted September 2020, available online October 2020

ABSTRACT

This study deals with the consumers' perceived risk and its determinants for fresh tomatoes in Albania. Survey data are analyzed using ordered logistic regression.Consumers associate a high level of benefits with the consumption of fresh tomatoes but have severe doubts about food safety and rate the average level of food safety risk as high as 6.66 on a scale from 0 to 10.Consumers' knowledge of food safety, their perceptions about the reliability of food safety information, the government's ability to ensure safety, negative experiences with tomato consumption, consumer age, and family size are key determinants of perceived food risk, while gender, education, and income did not prove to be significant. The results provide the basis for appropriate actions by government and food system actors in improving food safety and consumers' trust in food safety assurance.

Keywords: *benefit; determinant of risk; food safety; ordinal logistic regression; perceived risk*

JEL*: C5, Q13, Q18, R2*

1 Introduction

Tomatoes account for about 37% of total vegetable production in Albania. Tomato production from greenhouses has grown steadily from year to year and currently accounts for 48% of tomato production (INSTAT, 2019). Tomato is one of the most consumed vegetables in Albanian families.

The positive trend in the production and consumption of fresh tomatoes during the last decade is parelleled by a marked increase in the use of new tomato production technologies, coupled with the use of various chemicals, additives, and other growth stimulating inputs. Research has shown that Albania faces serious problems in the national food safety control system (Skreli and Imami, 2019). There are indications (from the media) but also studies that reveal use of stimulants, use above the norm of chemicals, or high residues of pesticides in tomatoes (Skreli and Imami, 2019). These technologies and inputs have increased productivity of tomato production but, at the same time, consumer concerns about food safety.

As consumption is only one stage in the tomato value chain, perceived risk may influence decision making processes at all stages of the value chain (Mitchell, 1992) affecting not only consumers but people engaged in production, marketing, distribution or policy. While policy makers are not directly involved in the tomato value chain, they need to know about people's perceptions and reactions (Slovic, 1987) for implementing an effective food safety policy and strengthening the food safety control and monitoring systems.

However, there is not yet an aggregate estimation of consumers' perception of food safety, the level of risk they associate with the consumption of fresh tomatoes or the factors they take into account in forming their opinion about food safety and consumption risks.

It is the objective of the paper to provide insights into consumers' perception, supporting food chain actors and the government in formulating and implementing appropriate actions for improving food safety and assuring that consumers' perceptions match actual food safety efforts.

To this end, the study will focus on answering the following questions:

1-Which is the aggregate level of risk perceived by consumers of fresh tomatoes?

2-Which are the most relevant factors that Albanian consumers take into account in judging the risks from consuming fresh tomatoes?

The paper introduces into the subject by first outlining the conceptual framework and related literature including major concepts and findings from relevant studies. Following chapters deal with data collection and analysis. The paper concludes with a discussion of results and final comments.

2 Conceptual framework and review of literature

According to FAO-WHO (2003), food safety refers to all those hazards, whether chronic or acute, that may make food injurious to the health of consumers; hazard is an agent or condition that may cause harm. Three categories of hazards are associated with all types of food, including fresh produce: biological, chemical, and physical (FAO-WHO, 2003; UN, 2007). Food safety can be termed in a narrow sense, as well as in a wider sense (Ritson and May, 1998). In the narrow sense, food safety is the opposite of food risk, i.e. the probability of not getting a disease as a consequence of consuming food. In a broader sense, food safety can include the nutritional quality of food and wider concerns about the properties of unfamiliar foods (Grunert, 2005).

There are various definitions of risk. According to the Merriam Webster Dictionary, risk is the possibility of loss or injury (MWD, 2019). According to Business Dictionary (BD, 2019), risk is a probability or threat of damage, injury, liability, loss, or any other negative occurrence that is caused by external or internal vulnerabilities and that may be avoided through preemptive action. In the context of food it is the possibility that a certain hazard in food may have a negative effect of a certain magnitude on the health of consumers. According to the Albanian Law of Food (2008), the risk is both the possibility of an adverse effect on health as well as the severity of this effect as a consequence of the presence of one or more damaging elements in food. Risk has to be differentiated from uncertainty (BD, 2019), where neither the probability nor the mode of occurrence is known (Taylor, 1974),

The food safety risk can be objective or subjective. Objective food safety is the one being assessed by scientists and food experts. Subjective food safety is that existing in the mind of consumers (Grunert,

2005). Social scientists do not accept the notion of real or objective risk, arguing that risk is inherently subjective, i.e. risk is subjective because it does not exist independently of our minds and cultures (Slovic, 1992). In this context, risk means different things to different people and cannot be measured independently of people's minds and cultures (Finucane and Holup, 2005). The literature points out that risk might be self-imposed or technology-based. Self-imposed risk is more acceptable to consumers than technology-based risk. The risk is perceived to be greater when new and unfamiliar technologies are used by farmers (Grunert, 2005; Kaptan et al., 2017) and familiar risks are perceived less severe than unfamiliar ones (Grunert, 2005).

Perception as a concept is a process through which individuals are exposed to information, participate in information processing, and understand the information (Mowen, 1990). Risk perception is the belief (whether rational or irrational) held by an individual, group, or society about the chance of occurrence of a risk or the extent, magnitude, and timing of its effect BD (2019). Slovic (1987) defines risk perception as intuitive risk judgments made by consumers. Risk perception is part of the buyers' decision process, which is composed of five stages: problem recognition, information search, evaluation of alternatives, and purchase decision and post-purchase behavior (Mitchell, 1992).

Perceptions about risk are closely related to food safety protection systems that are in place (EU, 2008) and need to be taken into account in initiatives towards the organization of such systems. Besides, a strong consumer protection system can contribute to more sustainable growth (EU, 2008).

Two major theories exist regarding risk perception, the psychometric paradigm, and the cultural theory. The psychometric paradigm focuses on understanding how people perceive health risks associated with different types of technologies. According to cultural theory, the perceived risk is closely related to cultural adherence and social learning (Oltedal et al., 2004; Finucane and Holup, 2005). Some researchers, however, such as Wildawsky and Dake (1990), try to argue that the cultural theory is not a very precise predictor of risk perception.

Table 1 summarizes findings from research done by different authors about the effect and its direction for different possible factors on the level of consumers' perception of food safety risk.

Based on the literature review, the purpose of the study and the research questions, we have formulated the following research hypotheses:

Hypothesis A:
The level of consumers' perceived risk of tomato food safety is associated positively with:

- -Gender, with women perceiving risks higher than men;
- -The size of the consumer's family;
- -Consumer's age;
- -The frequency of adverse effects, as well as taking medication at home or hospitalization in the past of at least one family member;
- -The individual formal education;
- -Household's income.

Hypothesis B:
The level of consumers' perceived risk of tomato food safety is associated negatively with:

- -The perceived level of benefits of tomato consumption;
- -The level of consumer knowledge about food safety;
- -The consumer's perception of the effectiveness of state control over food safety;
- -The reliability of information coming from the government;
- -The consumers' perception of government to guarantee food safety.

Table 1.
Effect of some factors on consumers' perceptions of food safety risk

Variables	Positive relationship	Negative relationship	No effect
-Gender (Females)	Flynn et al., 1994; Slovic 1999; Dosman et al., 2001; Baker 2003; Shroeder et al., 2007; Tonsor et al., 2009.		Flynn et al., 1994 found no difference between nonwhite men and women; Roosen et al., 2004.
-Education (More education)	Flynn et al., 1994; Roosen et al., 2004; Shroeder et al., 2007.		Baker, 2003; Tonsor et al., 2009.
-Age	Dosman et al., 2001; Shroeder et al., 2007; Zorba and Kaptan,2011.	Tonsor et al., 2009.	Baker, 2003.
-Income	Flynn et al., 1994; Dosman et al., 2001; Roosen et al., 2004.	Tonsor et al., 2009.	Baker,2003.
-Negative personal consumption experiences including self been sick	Venturas-Lukas 2004; Tonsor et al., 2009.		
- Knowledge (More knowledge)		Roosen et al., 2004.	
- Government capacity (More capacity)		Omari et al., 2017.	
-Trust in government (More trust)		Frewer et al., 2008; Tonsor et al., 2009; Kim et al., 2011; Omari et al., 2018.	
-Benefit		Alhakami and Slovic, 1994.	

3 Data and method

Primary data were collected through a survey with 834 randomly selected individuals from the Tirana city. It was springtime when the survey was carried out, thus data are related to greenhouse tomato production. A detailed description of the variables for which data were collected as well as their measurement scales and categories is summarized in the appendix.

The method of ordered logistic regression (Ologit) has been used. If Y is the dependent ordinal variable with M categories, the general form of the ordered logistic regression with ***k*** independent variables or factors is the following:

$$P_j = P(Y \leq j) = \frac{\exp(a_j - BX)}{1 + \exp(a_j - BX)} \text{ for } j=1,2,\ldots M-1$$

Where X is the ensemble of ***k*** independent variables with various measurement scales. Each of the variables can have several categories (values or variants). As for example, the perceived degree of risk is an ordinal variable and its categories are the numbers from 0 to 10, with 0 meaning that the consumption is absolutely free of risk and 10 meaning the highest grade of risk. Some variables have a Likert-scale expression, such as government capacity to ensure safe tomato. Variants or categories of this variable are: 1=Strongly disagree, 2=Disagree, 3=Somewhat agree, 4=Agree, 5=Strongly agree. Of course, in the estimation phase only the numbers representing the categories can be used.

B is a vector of coefficients in front of the variables. They are the same for each of (M-1) categories of the dependent variable, whereas a_j are (M-1) intercepts, one for each category of the dependent variable. P_j are cumulative probabilities; they are probabilities of risk of the j^{th} or previous categories of the dependent variable for given values of factors X. Regression coefficients are the same for each category but the free parameter is specific for each category. Based on this, the probability p_j of the risk for exactly

category j^{th} is the difference between the cumulative probabilities of being in category ***j*** and category ***(j-1)***:

$$\mathbf{p_j=P_j-P_{j-1}} \text{ for } j=2,\ldots M-1$$

For the last category $p_M=1-P_{M-1}$, while for the first category $P_j=p_j$.

Exponentiated coefficients Exp (B) of the ordered model are partial odds ratios for being in the higher rather than the lower half of the dichotomy. These odds are assumed to be the same for each dichotomy. In the case of one dependent variable with M=3 categories (see Risk in Table 2), two dichotomies could be formed:

Dichotomy 1: Low risk vs. (Moderate and High risk)
Dichotomy 2: (Low and moderate risk) vs. High risk

Controlling for the other explanatory variables, an increase in X by one unit is associated with (1-exp (B))*100 resulting in an increase (if B>0) or a decrease (if B<0) in odds of being in higher levels of the risk dichotomy. Thus, factors with EXP (B)>1 show a positive effect on the level of the dependent variable, whereas factors with EXP (B) <0 show a negative effect.

Following Wooldridge, if explanatory variables have a nominal or ordinal measurement scale they should be replaced by a set of dummy variables (Wooldridge, 2013; p. 235-238). The number of dummies used for a given nominal or ordinal variable is the number of categories of the variable minus one. Thus, for education, which has three categories, we used two dummies. The first (elementary level) has been taken as a base category, while DEDU_2 and DEDU _3 are two dummies, for the second and third categories. The values of these dummies are:

DEDU_2=1 if EDU=2 **DEDU_2=0 if EDU=1 or EDU=3**
DEDU_3=1 if EDU=3 **DEDU_3=0 if EDU=1 or EDU=2**

To estimate the models we used the Maximum Likelihood Estimator (MLE). The model and the coefficients can be tested using the Wald test, t (Student) test method, and the F (Fisher) test. To test whether adding new variables in the model improves it, the likelihood ratio (LR) test could be used.

More technical details on ordinal models could be found in (Gujarati, 2003; Benoit, 2012; Wooldridge, 2013; Osmani and Kambo, 2019).

4 Results

Table 2 shows some descriptive statistics for some of the variables included in the study.

Table 2.
Summary Statistics for some variables

Variable	Mean	Min	Max
AGE	38.10	18.00	80.0
SIZE	4.70	1.00	10.0
KNOWL	5.39	0.00	10.0
RISKOR	6.66	0.00	10.0
CONCERN	5.31	0.00	10.0
BENEFIT	5.76	0.00	10.0
STATECON	3.81	0.00	10.0
GOVCAP	2.75	0.00	4.00
FRENEG	0.81	0.00	2.00
GOVTRUST	1.36	0.00	3.00

We found that the average perceived level of risk (RISKOR) is very high (6.66 on a scale from 0 to 10) meaning that the perceived level of food safety is very low (10-6.71=3.29) while the average level of the benefit derived from consumption (BENEFIT) is at level 5.76. Some variables are rated quite low by consumers. Governmentr capacities (GOVCAP) to ensure food safety reached only a level of 2.75 or 27.5%, trust on the information provided by the government (GOVTRUST) only a level of 1.36 or less than 50%, etc.

To see the effects of various variables on the perceived level of risk as a dependent variable we used the Ordered Logit model (Ologit). This model was estimated for the entire population of the sampled individuals to obtain aggregate results about the effects of the potential determinants on the consumers' perceived level of risk. Then gender-based separate models have been estimated (for males and female subpopulations), education-based separate models (for secondary and superior sub-populations), and religion-based models (Muslim and Christian subpopulations). The aim of these models is the identification of relationships between risk level and its potential factors within these homogeneous subpopulations.

In the beginning, the aggregate Ologit risk model has been estimated based on the full data sample (Table 3). The model is significant (see likelihood ratio test at the end of Table 3) and has good predictive power (Likelihood ratio test: Chi-square(36) = 190.082, Prob=0.0000). Positive signs in front of the variables show a positive effect of the respective variable on the perceived risk, whereas negative signs show a negative effect on the perceived risk. Thus, older people (AGE), those who have had medical treatment (MEDICAL), those who in the past have had more frequent negative effects from the consumption of tomatoes (FRENEG), and people with more knowledge (KNOWL) about food safety tend to perceive higher risk levels.

Bigger families(SIZE), people who have higher confidence in the information distributed by the government (GOVTRUST), people who rate higher the performance of state control (STATECON), those trusting in the government capacity to ensure that safe tomato is produced and consumed (GOVCAP) tend to perceive lower risk level. Other variables such as GENDER, education (EDU), religion (RELIG), INCOME, consumption (CONS), and others do not have a significant effect on the perceived level of risk.

The interpretation of the EXP (B) coefficients (last column) is of great value. Thus, if the household's size (see the EXP (B)=0.857 coefficient in row 3 of Table 3) is increased by one, controlling for the other variables, the odds of being in the higher part of the dichotomy are 4.3% (calculation 0.857-1)*100=-14.3%), that is lower than the odds of being in the lower part of the dichotomy; differently said, the odds of perceiving higher risk reduce by 14.3%.

Table 3.
The aggregate (full sample) Ologit, Dependent variable: RISK

Nr.	Variables	Coefficient	p-value	Sign.	EXP(B)
1	AGE	0.015	0.009	***	1.015
2	GENDER	-0.050	0.750		1.052
3	SIZE	-0.154	0.013	**	0.857
4	INCOME	0.000	0.772		1.000
5	CONS	-0.025	0.657		0.975
6	MEDICAL	0.329	0.072	*	1.389
7	DFRENEG_1	0.623	0.001	***	1.865
8	DFRENEG _2	0.190	0.354		1.209
9	DBENEFIT_2	0.114	0.575		1.121
10	DBENEFIT_3	0.006	0.978		1.006
11	DGOVTRUST_2	-0.377	0.116		0.686
12	DGOVTRUST_3	-0.280	0.264		0.756
13	DGOVTRUST_4	-1.084	0.004	***	0.338
14	DSTATECON_2	-0.452	0.016	**	0.636
15	DSTATECON_3	-0.377	0.095	*	0.686
16	DKNOWL_2	-0.027	0.940		0.973
17	DKNOWL_3	0.394	0.263		1.483
18	DKNOWL_4	1.194	0.002	***	3.300
19	DGOVCAP_2	-0.789	0.052	*	0.454
20	DGOVCAP_3	-0.449	0.223		0.638
21	DGOVCAP_4	-0.721	0.039	**	0.486
22	DGOVCAP_5	-0.493	0.157		0.611
23	DRELIG_2	0.025	0.885		1.026
24	DRELIG_3	-0.363	0.233		0.696
25	DEDU_2	-0.008	0.973		0.992
26	DEDU_3	0.154	0.577		0.857
	Likelihood ratio test: Chi-square(36) = 190.082 [Prob=0.0000]				

Note 1 : (*) Denotes statistical significance at 0.1 significance level; (**) Denotes statistical significance at 0.05 significance level and (***) denotes statistical significance at 0.01 significance level.
Note 2: Numbers at the end of the dummy variables (for example 3 at the end of DEDU_3) show the category of the ordinal explanatery variable (in this case 3 is the category of high education). To avoid the collinearity in the model, no dummy is included for the first category. See also explanations on page 6.

For the MEDICAL variable (see the Exp(B) coefficient in row 6 of Table 3), individuals who have had medical treatment have odds 38.9% greater than individuals not having medical treatment to perceive the risk in the higher part of the dichotomy (the calculation: 1.389-1)*100=38.9%). This is the same for both dichotomies.

The coefficient EXP (B) =0.338 for the variable GOVTRUST_4 (see the EXB (B) coefficient in row 13 of the Table 3) shows that individuals being in the higher part of the dichotomy have 66.2% lower odds (the calculation: (0.338-1)*100=-66.2%) than individuals being in the lower part of the dichotomy (for example those that strongly agree with the statement “Government supplies trustful information” with those that do not strongly agree). So, individuals who believe more in the information shared by government agencies perceive a much lower risk associated with food safety. For more details regarding technical comments of the coefficients see Benoit (2012).

In the second step, as we announced above, we estimated separate models for females and males. The purpose is to identify risk-related factors within these subpopulations. The estimated models are shown in Table 4.

Table 4.
The Ologit models by gender, dependent variable: RISK

	Females				Males			
Variables	**Coefficient**	**p-value**	**Sign.**	**EXP(B)**	**Coefficient**	**p-value**	**Sign.**	**EXP(B)**
AGE	0.024	0.011	**	1.024	0.014	0.091	*	1.014
SIZE	-0.204	0.017	**	0.816	-0.148	0.137		0.863
INCOME	-0.001	0.543		0.999	0.000	0.959		1.000
CONS	-0.020	0.808		0.980	-0.046	0.575		0.955
MEDICAL	0.118	0.646		1.126	0.504	0.069	*	1.655
DFRENEG_1	0.827	0.002	***	2.288	0.337	0.250		1.401
DFRENEG_2	-0.004	0.990		0.996	0.391	0.218		1.478
DBENEFIT_2	0.130	0.655		1.139	0.070	0.825		1.072
DBENEFIT_3	0.005	0.988		1.005	0.029	0.935		1.030
DGOVTRUST_2	-0.845	0.016	**	0.430	0.196	0.590		1.217
DGOVTRUST_3	-0.657	0.084	*	0.519	0.213	0.567		1.237
DGOVTRUST_4	-1.727	0.001	***	0.178	-0.399	0.527		0.671
DSTATECON1_2	-0.235	0.384		0.790	-0.844	0.004	***	0.430
DSTATECON1_3	-0.408	0.196		0.665	-0.373	0.285		0.689
DKNOWL_2	0.143	0.754		1.154	0.015	0.982		1.015
DKNOWL_3	0.738	0.101		2.092	0.342	0.597		1.408
DKNOWL_4	1.783	0.000	***	5.949	0.936	0.158		2.551
DGOVCAP_2	-0.636	0.264		0.529	-1.148	0.083	*	0.317
DGOVCAP_3	-0.419	0.422		0.658	-0.549	0.352		0.578
DGOVCAP_4	-0.596	0.234		0.551	-1.168	0.037	**	0.311
DGOVCAP_5	-0.041	0.934		0.960	-1.235	0.028	**	0.291
DRELIG_2	0.461	0.065	*	1.585	-0.395	0.143		0.673
DRELIG_3	-0.449	0.278		0.639	-0.135	0.799		0.874
DEDU_2	0.219	0.564		1.245	-0.075	0.834		0.928
DEDU_3	0.435	0.317		1.545	0.019	0.964		1.019
Likelihood ratio test: Chi-square(35) = 140.926 [P=0.0000]					Likelihood ratio test: Chi-square(35) = 90.7401 [P=0.0000]			

The reader can easily see that knowledge (KNOWL), frequency of adverse effects in the past (FRENEG), and age have a positive effect, while the size of the family (SIZE) and trust in government information (GOVTRUST) has a negative effect on the perceived risk by females. For males, it is government capacities (GOVCAP), medical treatment (MEDICAL), and AGE significantly affecting the level of perceived risk. Comments of the EXB (B) coefficients and related calculations can be made in the same way as the coefficients of Table 3. The only distincion is that comments and calculations based on table 4 could be also gender disaggregated.

Then, two separate models for Muslim and Christian sub-populations were estimated. The purpose is to identify significant risks-related factors within these populations.The estimated models are shown in Table 5. For Muslims, it is government capacity (GOVCAP), frequency of negative effects (FENEG), knowledge (KNOWL), AGE, and family size that affect significantly the level of perceived risk. For Christians significant it is knowledge (KNOWL), government capacity (GOVCAP), state control (STATECON), AGE, GENDER, MEDICAL, and INCOME.

Table 5.
Ologit models by religious affiliation, dependent variable: RISK

	Muslim				Christian			
Variables	**Coefficient**	**p-value**	**Sign.**	**Exp(B)**	**Coefficient**	**p-value**	**Sign.**	**EXP(B)**
AGE	0.020	0.009	***	1.020	0.021	0.075	*	1.021
GENDER (1=male)	0.280	0.175		1.323	-0.861	0.009	***	0.423
SIZE	-0.193	0.019	**	0.824	-0.048	0.705		0.953
INCOME	0.001	0.166		1.001	-0.004	0.001	***	0.996
CONS	-0.072	0.307		0.930	0.013	0.908		1.013
MEDICAL	0.369	0.120		1.446	0.681	0.087	*	1.976
DFRENEG_1	0.781	0.001	***	2.184	0.417	0.300		1.517
DFRENEG_2	0.083	0.755		1.087	-0.016	0.968		0.984
DBENEFIT_2	0.455	0.091	*	1.575	0.357	0.432		1.430
DBENEFIT_3	0.175	0.538		1.191	0.350	0.465		1.419
DGOVTRUST_2	-0.516	0.083	*	0.597	0.500	0.355		1.648
DGOVTRUST_3	-0.384	0.223		0.681	0.125	0.818		1.133
DGOVTRUST_4	-0.733	0.134		0.480	-1.087	0.156		0.337
DSTATECON_2	-0.453	0.056	*	0.636	-0.815	0.051	*	0.443
DSTATECON_3	-0.303	0.295		0.739	-0.665	0.161		0.514
DKNOWL_2	-0.291	0.545		0.748	-0.436	0.540		0.647
DKNOWL_3	-0.084	0.860		0.919	0.884	0.183		2.422
DKNOWL_4	0.862	0.094	*	2.367	1.344	0.058	*	3.835
DGOVCAP_2	-1.173	0.023	**	0.309	-1.989	0.076	*	0.137
DGOVCAP_3	-0.416	0.373		0.660	-2.710	0.011	**	0.067
DGOVCAP_4	-0.886	0.046	**	0.412	-2.509	0.017	**	0.081
DGOVCAP_5	-0.782	0.075	*	0.457	-2.102	0.045	**	0.122
DEDU_2	0.027	0.933		1.027	0.068	0.883		1.071
DEDU_3	0.518	0.162		1.678	-0.411	0.439		0.663
Likelihood ratio test: Chi-square(34) = 138.63, [P=0.0000]					Likelihood ratio test: Chi-square(34) = 92.162 [P=0.0000]			

In the end, two separate models for the second and superior subpopulations were estimated with the purpose of identifying risk-related factors within these populations. The estimated models are shown in Table 6. The only distincion is that comments and calculations based on table 5 could be also religion disaggregated.

For people with superior education what matters most in terms of risk perception is the frequency of negative effects (FRENEG) from the consumption of tomato. For people with secondary education it is the knowledge (KNOWL) and frequency of negative effects (FRENEG) that matter most, then state control (STATECON), and trust in the information provided by the government (GOVTRUST). The interpretation of the EXB (B) coefficients could be done in the same way as those of Table 3, but they will be disaggregated by education.

Table 6.
Ologit models by education level, dependent variable: RISK

	Secondary education				Superior			
Variables	**Coefficient**	**p-value**	**Sign.**	**EXP(B)**	**Coefficient**	**p-value**	**Sign.**	**EXP(B)**
AGE	0.018	0.019	**	1.019	0.006	0.702		1.006
GENDER	-0.051	0.813		0.950	-0.148	0.676		0.863
SIZE	-0.096	0.275		0.908	-0.142	0.297		0.868
INCOME	-0.001	0.443		0.999	0.000	0.905		1.000
CONS	-0.049	0.522		0.952	-0.106	0.373		0.900
MEDICAL	0.381	0.129		1.463	0.267	0.486		1.306
DFRENEG_1	0.673	0.008	***	1.959	0.688	0.064	*	1.990
DFRENEG_2	0.049	0.855		1.051	0.828	0.076	*	2.290
DBENEFIT_2	0.580	0.034	**	1.787	-0.688	0.108		0.503
DBENEFIT_3	0.175	0.558		1.191	-0.271	0.563		0.762
DGOVTRUST_2	-0.218	0.521		0.804	-0.684	0.175		0.505
DGOVTRUST_3	-0.502	0.151		0.606	0.435	0.416		1.545
DGOVTRUST_4	-1.369	0.011	**	0.254	-0.046	0.951		0.955
DSTATECON_2	-0.424	0.083	*	0.655	-0.507	0.205		0.602
DSTATECON_3	-0.538	0.098	*	0.584	-0.671	0.159		0.511
DKNOWL_2	-0.150	0.757		0.861	0.618	0.489		1.855
DKNOWL_3	0.344	0.465		1.410	0.789	0.364		2.202
DKNOWL_4	1.875	0.000	***	6.521	1.092	0.218		2.979
DGOVCAP_2	-0.950	0.100		0.387	-1.325	0.163		0.266
DGOVCAP_3	-0.339	0.523		0.713	-0.917	0.232		0.400
DGOVCAP_4	-0.686	0.175		0.504	-0.910	0.199		0.403
DGOVCAP_5	-0.342	0.498		0.710	-0.738	0.334		0.478
DRELIG_2	0.199	0.401		1.220	-0.419	0.252		0.658
DRELIG_3	-0.206	0.646		0.814	-0.926	0.083	*	0.396
Likelihood ratio test: Chi-square(34) = 124.369 [P=0.0000]					Likelihood ratio test: Chi-square(34) = 76.3 [P=0.0000]			

5 Discussion

In our research, the main issue that we discuss is the perceived risk of consuming fresh tomato by consumers and we try to identify some of its determinants. Besides, we tried to identify whether there are significant differences in risk factor effects between women and men, consumers of different religions, and different levels of education.

Calculations showed (see Table 2) that the average level of perceived risk was quite high, 6.66 on the horizontal measurement scale from 0 to 10. At the same time, the perceived level of tomato consumption benefits was also quite high, 5.76. This indicates high tomato consumption despite its related risks. At least two hypotheses can be raised around this small (almost equal to 1) difference between these results. First, it might be explained by the great preference that Albanian consumers have for tomatoes, and second, it can also be explained by the lack of competitive or substitute products (from imports) or the unaffordable prices of the latter. Furthermore, the effectiveness of the state control is rated at 3.81, which is at 38.1% of the maximum level, whereas government capacity to ensure food safety is rated at 2.75 or 27.5% of the maximum value possible. These assessments suggest a significant need for improvement in relation to these indicators.

The following Table 7 summarizes the main findings from the estimated econometric models.

Table 7.
Relationship between the perceived risk and its' factors or determinants

Factors	Sign of r relation-ship as per hypothesis	Sign of relation-ship as per data analysis	Sign of relationship as per literature
Gender (women perceive higher risk)	+	No effect	Not in line with the literature
Family size	+	-	No support from literature
Consumers' age	+	+	In line with the literature
Frequency of adverse effects	+	+	In line with the literature
Consumers' medication	+	+	Partly in line with the literature
Education	+	No effect	Partly in line with the literature
Household's Income	+	No effect	Partly in line with the literature
Benefits from consumption	-	No effect	Not in line with the literature
Consumers' Knowledge	-	+	Not in line with the literature
Effectiveness of state control	-	-	No support from literature
Reliability of government information	-	-	In line with the literature
Government capacity to guarantee food safety	-	-	In line with the literature

Regarding gender, though its overall effect appears to be insignificant, male Christians tend to perceive a higher risk. According to the literature, women tend to perceive higher risks than men (Slovic 1999; Dosman et al., 2001; Baker 2003; Shroeder et al., 2007; Tonsor et al., 2009). A hypothetical reason why Albanian women do not significantly differ from men in risk perception is that they might have different cultural characteristics from women in other countries.

In terms of family size, although the study identifies an overall negative effect on perceived risk, in terms of gender, its effect is negative and significant but only for women, and in relation to religion, its effect is significant and negative only for Muslims. The hypothesis of interest is rejected and we want to argue that this is so probably because large families have as their priority providing food to members but not the quality of food or its safety.

The effect of consumer knowledge on the perceived risk level turned out to be positive not only . for the entire population but also for all sub-populations. We remind the reader that the literature shows a negative relationship between knowledge and risk (Roosen et al., 2004).

Income in general results of no effect, but it seems to affect negatively the perception of risk for Christian. Findings from the literature show both positive cases (Flynn et al., 1994; Dosman et al., 2001; Roosen et al., 2004.) as well as negative (Tonsor et al., 2009), in some cases even no effect (Baker, 2003).

The effect of consumers' confidence on the ability of the state control institutions to ensure product safety results in a negative effect on the level of risk both in general and within all sub-populations. We argue this was a predictable result, as with effective public control institutions there would be fewer reasons for food safety risks.

Confidence in the government's capacity to guarantee tomato safety results in a negative effect not only in general for the entire population, as well as for males, Muslims, and Christians. Thus, in general, this result is almost fully in line with the literature findings (Omari et al., 2017).

Religion as a factor is of no general significant effect, except for the population of Muslim women, who tend to perceive it higher than non-Muslim women. Likewise, highly educated consumers tend to underestimate the risk of food safety.

6 Conclusions

Over the last ten years in Albania, tomato production and the application of new technologies, coupled with the use of various chemicals, additives, and other stimulating inputs marked an increase. These have increased productivity, but under a weak food safety monitoring and control system, they have contributed to increased food safety risks and consumer concerns about the safety of the product.

As the risk to food safety could affect a large number of people, consumer perceptions about the quality and safety of the fresh tomato are of huge importance for all actors along the tomato value chain. These risks may point out the need and importance of improvements in the performance of each actor, from the farmer to the government, to reduce health hazards and increase consumer confidence in the product they consume.

Primary data are used to learn about the perceived risk and its potential determinants. Data was collected through a random survey in the city of Tirana for over 800 individuals above the age of 18 years. To analyze data we applied the method of ordinal logistic regression.

The difference between the aggregate level of the perceived risk and the aggregate level of the perceived consumer benefits derived from tomato consumption is negligible (almost 1). This shows that tomato is massively consumed, regardless of these risks. This can show that presence in the market of competitive products or its substitutes would be of a huge role in discouraging the consumption of risky products.

The main factors that positively contribute to the formation of consumer perceptions of tomato safety are the age of the consumer, frequency of adverse effects from the consumption of tomato in the past, negative experiences with medication, and consumer knowledge about food safety. The main factors that negatively contribute are family size, the effectiveness of state control, government capacity to guarantee food safety, and public confidence in the information about food safety.

These results underscore the need for appropriate remedial action. Among the most important actions to be taken would be that of improving food risk management in all its components. A bigger role is needed for improvements in the ability and role of the government and its relevant institutions, as well as consumer and farmers associations, in reducing the risk. Also, improving policies and effectively enforcing rules and standards for tomato production, storage, and marketing would help in providing a more credible public perception of the safety risk. Furthermore, it would encourage farmers and all food chain actors to take measures to increase the quality and food safety of tomatoes.

Consumers need more and reliable information about tomato safety, including information transmitted through product labels, information about product origin, technologies, and inputs used by farmers for the production of tomato. This information not only will help consumers to better perceive safety issues regarding tomato but also make better purchase decisions. All these would be a support to farmers in selecting the right and most accepted production technologies by consumersand become more competitive in the market.

Study results indicate that knowledge is of utmost importance, in the sense that formal education may not be sufficient for the consumers to have realistic perceptions about food safety; that is, specific food-safety related knowledge has a larger role than education to play in this direction.

To this end, regular and well-designed consumers' awareness campaigns and targeted education programs could be effective tools in improving consumers' knowledge and attitude towards tomato food safety risks. Also, conducting regular objective food safety risk assessments and disclosure of information on consumer perceptions about food hazards and risks would serve as an effective orientation for a more realistic perception of the risk level by the consumers. Besides, it would also have a significant impact on promoting food safety at the very production stage.

Way forward

The need for further research in the field of food safety is enormous, but some research that can immediately be undertaken is a detailed study of the risk-benefit relationship. Another research can be focused on how consumer concerns about food safety are shaped, or which are factors influencing their formation, as well as policies they consider necessary to alleviate these concerns.

References

Albanian Law on Food, No.9863.(2016). Available at: http://aku.gov.al/wp-content/uploads/2016/06/Ligji-Nr-9863-dat%C3%AB-28.-1.-08-i-ndryshuar-me-26.03.20013.pdf.

Alhakami, A. S., Slovic, P. (1994). A Psychological Study of the Inverse Relationship Between Perceived Risk and Perceived Benefit. *Risk Analysis*, **14**(6). Available at: https://onlinelibrary.wiley.com-/doi/abs/10.1111/j.1539-6924.1994.tb00080.x.

Baker, G. A. (2003). Food Safety and Fear: Factors Affecting Consumer Response to Food Safety Risk. *International Food and Agribusiness Management Review*, **6**(1). Available at: https://pdfs.-semanticscholar.org/965d/3fc788c77ac7b58636c193f12df21113585e.pdf.

Benoit, K. (2012). Multinomial and Ordinal Logistic Regression. Available at: https://kenbenoit.net/assets/courses/ME104/ME104_Day8_CatOrd.pdf.

BD (Business Dictionary) (2019).Available at:http://www.businessdictionary.com/definition/risk.html.

CMA-Council of Ministers of Albania (2015). Inter-sector strategy for consumers' protection and market monitoring (Alb) (2014-2020).

Dosman, D. M., Adamowicz,W. L., and Hrudey S. E. (2001). Socioeconomic determinants of health- and food safety-related risk perceptions. *Risk Analysis*, **21**(2): 307-317. Available at: https://-www.ncbi.nlm.nih.gov/pubmed/11414539.

EU (2008). EU Consumer Policy Strategy 2007-2013 P6_TA (2008)0211. European Parliament resolution of 20 May 2008 on EU consumer policy strategy 2007-2013 (2007/2189(INI)) (2009/C 279 E/04). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52008IP0211andfrom=HR.

FAO-WHO (2003). Assuring Food Safety and Quality: Guidelines for strengthening national food control systems. *FAO Food and Nutrition Paper,* **76**. Available at:http://www.fao.org/3/a-y8705e.pdf.

Finucane, M. L., Holup, J. L. (2005). Psychological and cultural factors affecting the perceived risk of genetically modified food: an overview of the literature. Social science and medicine, 2005: 1603-1612. Available at: http://www.ask-force.org/web/Ethics/Finucane-Psychsocial-Cultural-Factors-2005.pdf.

Flynn, J., Slovic, P., and Mertz, C.K. (1994). Gender, Race, and Perception of Environmental Health Risks. Risk Analysis. Available at:https://core.ac.uk/download/pdf/84755609.pdf.

Frewer, L. J., Jonge, J. and Klee, E. (2008). Consumer Perceptions of Food Safety. MEDICAL SCIENCES - Vol.II. Available at: https://www.researchgate.net/publication/40105290_Consumer_perceptions_of_-food_safety.

Grunert, K. G. (2005): Food quality and safety: consumer perception and demand. *European Review of Agricultural Economics*, **32**(3): 369–391. doi:10.1093/eurrag/jbi011.

Gujarati, D. N. (2003): Basic Econometrics. 4th edition. McGraw Hill, New York.

INSTAT, (2019). Available at:http://databaza.instat.gov.al/pxweb/sq/DST/START__BU/ (accesssed August 19, 2019).

Kaptan, G., Fischer, A.R.H., and Frewer, L.J. (2017). Extrapolating understanding of food risk perceptions to emerging food safety cases. *Journal of Risk Research*. DOI: .10.1080/13669877.2017.1281330. Available at:http://dx.doi.org/10.1080/13669877.2017.1281330 (accesssed on January 14, 2019).

Kim, B.C., Khansa, L., and James, T. (2011). Individual Trust and Consumer Risk Perception. *Journal of Information Privacy and Security*, **7**(3): 3-12. https://doi.org/10.1080/15536548.2011.10855915.

MWD (Merriam Webster Dictionary) (2019). Available at: https://www.merriam-webster.com/dictionary/risk.

Mitchell, V. W. (1992). Understanding Consumers' Behavior: Can Perceived Risk Theory Help? *Management Decision*, **30** (3). Available at:http://dx.doi.org/10.1108/00251749210013050.

Mowen, J. C. (1990). Consumer behavior, 2nd edition, Macmillan Publishing Company, New York.

Oltedal, S., Moen, B.E., Klempe, H., and Rundmo, T. (2004). Explaining risk perception. An evaluation of cultural theory. Rotunde publikasjoner, Rotunde no. 85. Available at:http://-www.svt.ntnu.no/psy/Torbjorn.Rundmo/Cultural_theory.pdf.

Omari, R., Ruivenkamp, G.T.P.,and Tetteh, E. K. (2017).Consumers' trust in government institutions and their perception and concern about safety and healthiness of fast food. *Journal of Trust Research*, **7**,(2): 170-186. Available at:https://doi.org/10.1080/21515581.2017.1289099.

Omari, R., Arthur W., and Frempong, G. K. (2018). Competence of public institutions in food safety control: a consumer perception survey in Ghana. *Journal of Food Quality and Hazards Controls* , **5**:102-108. DOI: 10.29252/jfqhc.5.3.102.

Osmani, M., Kambo, A. (2019). Small-scale apple farmers' willingness to invest-the case of Korca region farmers in Albania. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, **69**(1): 309-323.

Ritson, C., Mai, L. W. (1998). The economics of food safety. *Nutrition and Food Science*, **98**(5): 253–259. Available at:https://doi.org/10.1108/00346659810224163.

Roosen, J., Hansen, K., and Thiele, S. (2004). Food safety and risk perceptions in a changing world. 84th EAAE Seminar, Zeist, The Netherlands, February 8-11, 2004. Available at:http://ageconsearch.umn.edu/record/25002/files/sp04ro01.pdf.

Schroeder, T., Tonsor, G., Pennings,J. M. E., and Mintert, J. (2007). Consumer Risk Perceptions and Attitudes about Beef Food Safety: Implications for Improving Supply Chain Management. *Contributions in Economic Analysis and Policy*, **7**(1):1848-1848. Doi: 10.2202/1935-1682.1848.

Skreli, E. Imami, D. (2019). Study for the greenhouse vegetable sector. Available at: http://aasf.com.al/wp-content/uploads/2019/06/Perimet_e_serres_Press.pdf.

Slovic, P. (1987). Perception of risk. Science 236: 280-285. Available at:http://www.heatherlench.com/wp-cont,ent/uploads/2008/07/slovic.pdf.

Slovic, P. (1992). Perception of risk: Reflections on the psychometric paradigm. In S. Krimsky and D. Golding (Eds.). *Social theories of risk*: 117-152. New York: Praeger. Available at:http://hdl.handle.net/1794/22510.

Slovic, P. (1999). Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield. *Risk Analysis*, **19**(4). Available at:https://org.uib.no/dyreavd/harm-benefit/Slovic%20Risk.pdf.

Taylor, J. W. (1974). The role of risk in consumer behavior. *Journal of marketing*, **38**(2): 54-60. DOI: 10.2307/1250198. Available at:https://www.jstor.org/stable/1250198.

Tonsor, G. T., Schroeder, T. C., and Pennings, J. M. E. (2009). Factors Impacting Food Safety Risk Perceptions. *Journal of Agricultural Economics*, **60**(3): 625–644 doi: 10.1111/j.1477-9552.2009.00209.x.

UN (2007). Improving the Safety and Quality of Fresh Fruits and Vegetables: A Training Manual for Trainers. Available at:https://unctad.org/en/docs/ditccom200616_en.pdf.

Ventura-Lucas, M. R. (2004). Consumer perceptions and attitudes towards food safety in Portugal. Available at:https://ageconsearch.umn.edu/record/24986/?ln=en.

Wildavsky, A., Dake, K. (1990). Theories of risk perception: Who fears what and why? *Daedalus*, **119**(4): 41-60. Available at:http://hdl.handle.net/10822/840519.

Wooldridge, J. M. (2013). Introductory econometrics: A modern approach. 5th edition, South Western Cengage Learning.

Zorba, N.N.D., Kaptan, M. (2011). Consumer Food Safety Perceptions and Practices in a Turkish Community. *Journal of Food Protection*, **74**(11): 1922-1929. Available at: https://doi.org/10.4315/0362-028X.JFP-11-126.

Annex

Table A.
Variables, their nature and measurement scale

Nr	Variables	Conceptualization	Code of the variable	Measurement Scale	Categories
1	Perceived degree of safety risk	How much harmful to health is consumption of tomato	RISKOR	Ordinal	0-10
2	Perceived degree of safety risk	How much harmful to health is consumption of tomato	RISK	Multinomial	1=Low, 1=Moderate, 2=High
3	Age		AGE	Ratio	Years
4	Education	Formal education at school	EDU	Multinomial	1=Elementary, 2=Secondary,3=Superior
5	Gender	Sex affiliation	GENDER	Binomial	0=Female, 1=Male
6	Household's size	Number of members	SIZE	Ratio	
7	Income	Gross household's revenue	INCOME	Ratio	(ALL)[1]
8	Religion	Religious affiliation	RELIG	Multinomial	1=Muslim, 2=Christian, 3=Other
9	Consumption	Amount of consumption in kg	CONS	Ratio	
10	Government has capacity to ensure safe tomato in the market	Adequate legal framework for food safety, legal enforcement and risk management capacity	GOVCAP	Multinomial	1=Strongly disagree, 2=Disagree, 3=Somewhat agree, 4=Agree, 5=Strongly agree
11	Frequency of negative effects from consuming tomato	Subjective evaluation of times occurring a negative effect on health	FRENEG	Multinomial	0=Never, 1=Rarely, 2=Frequently
12	Consumers' medication	Consumers taking medication at home or hospitalization	MEDICAL	Binomial	0=No, 1=Yes
13	State control guarantees safe tomato	Ability to perform effective food safety control	STATECON		1=Disagree, 2=Agree 3=Strongly agree
14	Benefits from consuming tomato	Nutritional value	BENEFIT	Multinomial	1=Low, 2=Moderate, 3=High
15	Government supplies trustful information	Information is accurate and reliable	GOVTRUST	Multinomial	1=Disagree, 2=Somewhat agree, 3=Agree, 4=Strongly agree
16	Consumers have sufficient knowledge about food safety	Consumers' knowledge about food safety	KNOWL	Multinomial	1=Disagree, 2=Somewhat agree, 3=Agree, 4=Strongly agree

[1]Albanian currency Lek