



## Consumer concern about food safety in Hanoi, Vietnam

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### ABSTRACT

A growing demand for safe and high quality food in Vietnam has been driven by not only the rise in living standard but also consumer worry about food safety. This paper analyses consumer concern about food safety and its determinants, taking into account spatial disparities. Using the mixed method which combines data from our consumer survey and group discussions in Hanoi, we found that consumers experienced a high level of anxiety about food safety. In their eyes, pesticide residues, food preservatives, and hormone in livestock were top three risky hazards. As a result, vegetables, fruits, and meat were considered to be most unsafe. The concern about food safety was shaped by the fear of food hazards, risk perception of protein food, risk perception of vegetables and fruits, food risk information acquisition, and region. Region was the most important determinant of food safety concern, suggesting that spatial disparities exist. With a limited capacity to self-supply food and weaker social and kinship networks, urban consumers perceived a lower level of control over food safety. Their level of worry about food safety, therefore, was higher than their rural counterparts. Hence, urban farming is important, as it will help reduce urban consumers' distress about food safety. To eliminate consumer fear in both rural and urban regions, better risk communication aiming at educating consumers about food hazards is required. Trust in food can be restored by better control of hazards and the safety of common food products.

### 1. Introduction

Like in many developing countries, Vietnam has witnessed shifts in food consumption pattern and spending, driven by structural and institutional changes in the food chain and the growth of income in recent years. The share of high-value products in household's food basket is increasing in both rural and urban area (WorldBank, 2016). The demand for safe and high-quality food demonstrates a growing trend (Mergenthaler, Weinberger, & Qaim, 2009) due not only to the rise in living standard but also the concern about food safety.

Managing food safety is a challenging task in Vietnam because of fragmented food chains and lack of enforcement of government regulations (Nga, Ninh, Van Hung, & Lapar, 2014). Consequently, the country is confronted with the prevalence of food-borne illnesses. The main culprit is microbial pathogens (causing one-third of food poisoning outbreaks), followed by toxin and chemical contamination (Sarter, Ha, & Anh, 2012). There are high levels of toxic residues with food additives, pesticides, and antibiotics exceeding the Maximum Residue Limits (MRLs) (WorldBank, 2006). Such food-related risk has even been particularly stressed by mass media. Extensive media coverage of food safety incidents has caused consumer's fear of some certain foods. Their confidence in food safety has eroded (Wertheim-Heck, Spaargaren, & Vellema, 2014b).

In this paper, we concentrate on consumer concern about food safety. To restore consumer trust in food, food producers and retailers in Vietnam need to understand how consumers feel about food safety. A better insight into the determinants of consumer concern about food safety will assist policymakers to reduce recent food fears. Moreover, an examination of spatial differences in consumer judgment of food safety risk is important, as it will support the development of effective food safety and risk communication strategies that are relevant to the local conditions.

Previous literature have explored consumer risk perception of particular hazards (Liu, Pieniak, & Verbeke, 2014; Omari, Frempong, & Arthur, 2018) and of specific food products (Lobb, Mazzocchi, & Traill, 2007; Tonsor, Schroeder, & Pennings, 2009). Moreover, some studies have discussed the concern about food safety, in general (Chen, 2013; Liu & Ma, 2016). Research that investigate links among risk perception of hazards, risk perception of particular food, and the concern about food safety are a few. In addition, risk perception was found to differ between rural and urban areas in some research (Liu & Ma, 2016; Verbeke & Viaene, 2000). Nevertheless, a comprehensive investigation on the disparity in risk perception between rural and urban region remains unexplored.

Some attempts have been made to explore consumers' perception of food safety risk in Vietnam (Figuíé, Bricas, Thanh, Truyen, & de l'Alimentation, 2004; Nguyen-Viet, Tuyet-Hanh, Unger, Dang-Xuan, &

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Grace, 2017; Van Hoi, Mol, & Oosterveer, 2009; Wertheim-Heck, Vellema, & Spaargaren, 2014a). However, most of these studies focus on risk perception for a specific food, such as vegetables, rather than risk perception of different hazards and food categories. Furthermore, the determinants of consumer worry about food safety have not been quantified in these studies.

The objectives of this paper are twofold. First, we provide an overview of consumer concern about food safety by region in Hanoi. Primary data from a consumer survey and three group discussions were integrated to explain consumer's feeling about food safety, food safety issues that are their concern, and their risk rating of some common foods. In addition, a comparison between rural and urban region was made. Second, the paper investigates the determinants of consumer concern about food safety risk, using the survey data. Then, information from group discussions was used to gain a more complete insight into significant predictors of the food safety worry.

## 2. Data and method

This is a mixed method research, which integrates data from a consumer survey with three group discussions. The concern about food safety and food safety risk perception are complex concepts, as they comprise social, cultural, and psychological dimensions. The use of mix method would provide a more comprehensive understanding of these concepts than either qualitative or quantitative approach alone.

### 2.1. Consumer survey

Survey data were gathered through face-to-face interviews with primary food shoppers in Hanoi, Vietnam from February to April 2017. We applied quota sampling (Kothari, 2004). Hanoi has 12 urban districts, 1 town, and 17 rural districts. The sample was selected from 7 districts in Hanoi (4 urban, 1 semi-urban, and 2 rural districts). We gave a certain quota (number of subjects to be selected) to each district. To ensure the diversity of the sample, we selected respondents from different socio-demographic profiles in the same district. The total sample size was 498, comprising of 230 rural and 268 urban respondents.

Table 1 shows income and education gaps between the rural and urban region. Urban districts of Hanoi experienced a stronger development in industry and service sectors than their rural counterparts. As a result, urban respondent's monthly income and their household monthly expense were nearly twice that of rural participants. In average, most of rural respondents had a high school qualification while the majority of urban respondents held a university degree. The family structure was also different between the two regions. Urban families were characterized by younger main food shoppers, having

**Table 1**

Background information on the respondents and their household by region.

Source: Authors' own data

Features	Rural (n = 230) (Mean & Std.)	Urban (n = 268) (Mean & Std.)
Repondent's monthly income (million VND)	4.958 <sup>a</sup> [2.98]	9.74 <sup>b</sup> [6.60]
Respondent's age	46.00 <sup>a</sup> [13.93]	38.32 <sup>b</sup> [10.06]
Respondent's education level	2.87 <sup>a</sup> [1.17]	3.90 <sup>b</sup> [1.90]
Respondent's gender (1 = male)	0.12 <sup>a</sup> [0.33]	0.12 <sup>a</sup> [0.33]
Number of children in the household	1.13 <sup>a</sup> [0.97]	1.38 <sup>b</sup> [0.85]
Number of family members	4.63 <sup>a</sup> [1.60]	4.22 <sup>b</sup> [1.12]
Household monthly expense (million VND)	6.09 <sup>a</sup> [3.89]	11.46 <sup>b</sup> [5.79]

Note: 22 000 VND = 1 USD; <sup>a,b</sup> Scores in one row with a different superscript are statistically significantly different at 5% using two-sample T-test; Numbers in brackets are standard deviation; Education levels are coded from 1 (no schooling) to 6 (postgraduate qualification).

more children, and smaller household size, as compared with rural households. This was attributed to the migration flow of youths from rural to urban where a greater earning potential was expected.

### 2.2. Survey questionnaire

The survey questionnaire covered 6 issues: 1) The concern about food safety, in general, 2) the concern about specific food safety issues, 3) risk perception of common foods, 4) trust, 5) information about food incidents, and 6) demographic characteristics.

The concern about food safety is the dependent variable. It refers to the level of worry about the safety of food, in general; not of a specific hazard or a particular food product. We measured the variable by the question: "To what extent are you worried about food safety today?". The responses were in a range from 1 "not worried at all" to 5 "extremely worried".

Respondents were then asked whether they were worried about 9 specific food safety issues. These issues covered four aspects of food safety: 1) chemical hazards (pesticide residue, food preservatives, hormone residue, drug residue, and heavy metal), 2) biological contamination (bacterial, micro-toxic contamination), 3) technological hazard (GMO-Genetic Modified Organism), and 4) lifestyle hazard (nutrition imbalance). The number of food safety issues reported by each respondent (ConcernIssue) was counted. We anticipate that the more food safety issues consumers are concerned, the higher level of worry about food safety they would have.

Risk perception of common foods (RiskCommon) was captured by six survey questions, asking about the risk rating of six corresponding common foods: egg, fish, milk, meat, vegetables, and fruit. These products are important in Vietnamese's diet but potentially involve a high risk, as they are perishable. Risk perceived of each product was measured by the level of personal health risk, as suggested by Tonsor, Schroeder, & Penning (2009). We used a 10 point- Likert scale with 1 meaning "not risky at all" and 10 indicating "extremely risky". We are interested in testing whether risk perception of common food products would translate into consumer concern about food safety.

Trust is a multi-dimensional construct (de Jonge, Van Trijpp, van der Lans, Renes, & Frewer, 2008) and the impact of trust is different across institutions (Chen, 2013). Hence, we used 4 items to measures trust in institutions that oversee management of food safety including local government, central government, farmers, and food retailers. Trust was measured by a 10 point- Likert scale, ranging from 1 (do not trust at all) to 10 (completely trust). We expect that trust will reduce the worry about food safety.

"Inform" reflects the frequency consumers acquire information about food safety incidents through 3 channels: mass media (TV), social media (Facebook), and word of mouth (relatives/friends). Earlier research found that consumers are most interested in these channels to receive food risk information ( Liu et al., 2014; Rutsaert, Pieniak, Regan, McConnon, & Verbeke, 2013). The responses were coded on a 5-point Likert scale from 1 (never) to 5 (always). To avoid response bias, respondents were given a definition for each response option. For examples, "always" means having heard or observed food safety incidents more than three times per week.

"Region" was included in the questionnaire to examine the disparity between rural and urban consumers in food safety evaluation. Spatial differences with regard to cultural and social aspects have been found (Beggs, Haines, & Hurlbert, 1996). Compared to urban settings, personal networks in rural settings are stronger, more complex, based more on kinship and neighborhood cohesion. Such differences might contribute to the differences in food safety worry between rural and urban consumers in some research (Liu & Ma, 2016; Verbeke & Viaene, 2000).

In addition, we were also interested in testing whether demographic characteristics influence food safety concern. Hence, the questionnaire contained 5 demographic variables including age, gender, income, education, and the presence of children in the family. Respondent's age,

monthly income, and education were treated as continuous variables while the presence of children in the family and gender were dummy variables.

A direct exposure to risky events often increases consumer's memory and imagination of the hazard (Kasperson et al., 1988). Direct experience with food poisoning increased risk perception in some research (Green, Draper, & Dowler, 2003). For this reason, the variable "Food-Poison" was included.

### 2.3. Focus group discussion

Three group discussions in urban, rural, and semi-urban districts were conducted to gain further insight into consumer's risk perception by listening to their own words. Since risk perception is multi-dimensional and complex (Roosen, Hansen, & Thiele, 2004), the integration of both quantitative and qualitative data is expected to provide a deeper understanding of this concept. Each group discussion had 8 participants who previously engaged in the survey. To achieve diversity as well as the homogeneity of group participants, we selected respondents who lived in the same village or apartment, was in the same age category but had different employment and income levels.

### 2.4. Data analysis

The data from group discussions were integrated with the survey data into the "result and discussion section" whenever feasible.

For survey data, to evaluate whether risk perception differs between rural and urban regions, two-sample T-test and Chi-square independent test were employed. The former is to compare the mean of risk rating of risk perceived from selected foods. The latter is to compare the percentage of respondents reporting a particular food safety issue of concern. Since the two-sample T-test relies on assumptions of normality and homogeneity of variance, the evaluation of normality and variance was conducted.

To quantify the determinants of food safety concern, the analysis was employed through two processes. Firstly, Principle Component Analysis (PCA) using varimax rotation was performed on 13 variables measuring "RiskCommonFood", "Trust", and "Inform". PCA reduces this set of variables into a few main components that can potentially affect consumer concern about food safety. Components with the eigenvalue larger than 1 and in the steeper part of the Cattel scree graph were retained, as suggested by Yong and Pearce (2013). Secondly, the retained components and other independent variables including "ConcernIssue", "Region", "FoodPoison", and demographic variables were regressed with the dependent variable "Food safety concern". Since the dependent variable has more than two ordered response levels, we employed ordered logit regression models.

To achieve a precise estimate of regression coefficients, some necessary assumptions for the ordered logit regression model were assessed. Our data had no issue with multicollinearity. Pearson's correlation coefficients between independent variables were in the range from 0.0 to 0.53, below the threshold of 0.7 (Dormann et al., 2013). The proportional odds assumption was fulfilled, as the evidence of Approximate Likelihood Ratio test (Wolfe & Gould, 1998). This test was insignificant ( $\chi^2 = 50.80$ ,  $df = 36$ ,  $p > 0.05$ ), indicating that there was the same set of coefficients across different response levels: "not worried at all", "a little bit worried", "worried much", "worried very much", or "extremely worried". Hence, the use of ordered logit regression was appropriate.

## 3. Results and discussions

### 3.1. Consumers' perception of food safety risk

Food safety concerns were high in Hanoi. A vast majority of respondents surveyed (95%) expressed that they either worried much, very much or extremely worried about food safety (Table 2). The concern about food safety was substantial in both rural and urban region.

**Table 2**

Consumer awareness about food safety in Hanoi Unit: %.

Source: Authors' own data

To what extent are you worried about food safety today?	Whole sample (n = 498)	Rural (n = 230)	Urban (n = 268)
Not worried at all	0.60	0.87	0.37
A little bit worried	4.82	3.91	5.60
Worried much	25.70	23.48	27.61
Worried very much	33.13	36.52	30.22
Extremely worried	35.74	35.22	36.19

**Table 3**

Percentage of respondents within rural and urban regions in Hanoi concerned about specific food safety issues.

Source: Authors' own data

Concerned issues	Total <sup>1</sup> (n = 498)	Rural <sup>2</sup> (n = 230)	Urban <sup>2</sup> (n = 268)
Pesticide residue	92.6	90.4 <sup>a</sup>	94.4 <sup>a</sup>
Food preservatives	88.8	86.5 <sup>a</sup>	90.7 <sup>a</sup>
Hormone in livestock production	78.9	76.5 <sup>a</sup>	81.0 <sup>a</sup>
Drug residue in meat	62.2	55.7 <sup>a</sup>	67.9 <sup>b</sup>
Heavy metal contamination	55.6	45.2 <sup>a</sup>	64.6 <sup>b</sup>
Bacteria contamination	50.2	47.4 <sup>a</sup>	52.6 <sup>a</sup>
Micro-toxic contamination	46.4	44.3 <sup>a</sup>	48.1 <sup>a</sup>
GMO food	43.6	36.5 <sup>a</sup>	49.6 <sup>b</sup>
Nutrition imbalance	31.1	30.9 <sup>a</sup>	31.3 <sup>a</sup>

Note <sup>1</sup>:% of respondents in the whole sample; <sup>2</sup>:% of respondents within the region.

<sup>a,b</sup> Percentages in one row with a different superscript are significant at 5% level, using Chi-Square test.

Risk perception is just a feeling (Slovic, 2010). Group discussions revealed that when talking about food safety, the words "fear", "worry", and "scary" were cited very often by participants. The anxiety about food safety was often linked with the fear of food poisoning and cancer. Like in Nguyen-Viet et al. (2017), there was a common belief that contaminated food was a primary cause of increasing cancer cases in Vietnam in recent years. Therefore, in consumer's eyes, eating became a risky proposition (Caplan, 2000). The risk was believed to be at a very high level because it had severe consequences, was beyond personal control, and invisible.

*"There are more cancer people day by day. This is because of yucky food"* (The urban group)

*"Eating now is so scary, but what I can do?"* (The semi-urban group)

*"The food now was much more unsafe than before. We buy, wash, and cook them but we cannot check how hazardous they are"* (The rural group)

As shown in Table 3, many food safety issues caused consumer worry. On average, one respondent surveyed reported 5.47 food safety issues of their concern. In agreement with previous studies on New Zealand, Australia, and Japan by Worsley and Scott (2000), Smith and Riethmuller (1999), our finding suggests that consumer concern about food safety was broad. In addition, respondents were concerned about chemical hazards more than biological (e.g., E. Coli) and lifestyle hazard (nutrition imbalance). This is because chemical hazards are perceived by consumers to be more uncontrollable, dread with the unknown consequence (Kher et al., 2013; McCarthy, Brennan, Ritson, & de Boer, 2006). In particular, pesticide residue, food preservatives, and hormone in livestock were the top three important issues that caused the anxiety of over 80% of respondents.

A higher percentage of urban people were concerned about every food hazard (Table 3). Chi-Square test results confirm the statistical association between three concerned issues including “drug residue in meat”, “heavy metal contamination” and “GMO food” with “region” ( $P < 0.05$ ). This shows a difference between rural and urban respondents in their attitude toward the three issues above. In addition, number of concerned hazards reported by an average urban respondent was higher than that of an rural participant (5.8 versus 5.08), indicating that consumer concern about food safety was broader in urban areas. These results suggest that food safety risk was perceived to be higher in the urban region.

Group discussions explored two reasons behind such disparity between the two regions. Firstly, perceived control dampened the worry about food safety in the rural region. Most of the rural participants reported that their families had a capacity to self-produce a multitude of fresh food for their family consumption. Therefore, they felt they were able to control the safety of their family food supply. Subsequently, they were more confident about food safety than urban people who were mostly unable to self-produce. Moreover, some rural families, though they did not produce their own foods, were able to access “safe food” by asking or buying food from their neighbors and kin who they trust. Having better social and kinship networks (Keyes, Cerdá, Brady, Havens, & Galea, 2014), rural residents perceived a better control over food safety, as compared to their urban counterparts. This lowered their worry about food safety, as a result.

*“We have lots of homegrown food. Homegrown foods are absolutely safe. We don't need to worry much about pesticides, GMO ...”* (The semi-urban group)

*“If I run out of vegetables I will go to my fields to pick up some. Sometimes, if the weather is not good, I don't want to go there at all. I just run to the market nearby and buy some from my relatives or local people who live in my village.”* (The rural group)

In addition to focusing on risk perception at hazard level, we also attended to risk perception at product level. The survey results are illustrated in Table 4. In the whole sample, four out of six products including vegetables, fruits, meat, and fish had the mean risk rating higher than neutral level. Vegetables, fruits, and meat were considered to be the top three riskiest items with the mean risk perceived at a high level (7.14, 6.74, and 6.70, respectively). Similar to previous research in Vietnam (Nguyen-Viet et al., 2017; Van Hoi et al., 2009), these results indicate that consumer's confidence in the safety of everyday food was low.

Group discussions sought explanations for a high level of risk perceived from vegetables, fruits, and meat found in the survey. Vegetables were ranked a top risk because of the fear of pesticide residue. Similar

**Table 4**  
Level of risk perceived from selected common foods within rural and urban regions, in Hanoi.  
Source: Authors' own data

Risk perceived from:	Whole sample (n = 498)		Rural (n = 230)		Urban (n = 268)	
	Mean	SD	Mean	SD	Mean	SD
Vegetables	7.14	2.01	6.77 <sup>a</sup>	2.11	7.45 <sup>b</sup>	1.86
Fruits	6.74	2.22	6.51 <sup>a</sup>	2.25	6.94 <sup>b</sup>	2.18
Meat	6.69	2.22	6.31 <sup>a</sup>	2.31	7.01 <sup>b</sup>	2.10
Fish	5.19	2.28	4.88 <sup>a</sup>	2.23	5.44 <sup>b</sup>	2.29
Milk	4.46	2.46	4.33 <sup>a</sup>	2.38	4.56 <sup>a</sup>	2.53
Egg	4.27	2.24	4.13 <sup>a</sup>	2.21	4.40 <sup>a</sup>	2.26

Note: Risk levels are in 10 point-scale from 1(not risky at all) to 10 (extremely risky).

SD: standard deviation; <sup>a,b</sup> Scores in one row with a different superscript are statistically significantly different at 5% using Two-sample T-test.

to a study in China by Cheng et al. (2016), we found that pesticides were evaluated as the most dangerous hazard because of its long term effects. When it comes to fruits, a common complaint was preservatives used in various fruits that consumers heard from mass media. In terms of meat, respondents were afraid of growth hormone in livestock production, which was responsible for a huge food scandal in 2015. This finding also explains why pesticide residue, preservatives, and growth hormone were the top three concerned issues of survey participants (see Table 3). Consumers believed that vegetables, fruits, and meat exposed the highest level of risk, as they were potentially contaminated by the most concerned hazards: pesticide, preservatives, and animal growth promoter.

*“They (vegetables) have pesticide (residues) that accumulate in our bodies day by day. Deadly dangerous!”* (The rural group)

*“Fruits are very risky because they are often soaked in preservatives. The fresher, shinier they look, the more they are likely to have been deepened in preservatives.”*(The semi-urban group)

*“Livestock is fed by industrial feed containing growth hormone, very dangerous”.* (The urban group).

Risk perception of common food differed across regions. As shown in Table 4, risk perceived from all food items were lower in the rural region. Noticeably, mean risk ratings of vegetables, fruit, meat, and fish were significantly different between rural and urban setting ( $P < 0.05$ ). This suggests that in general, rural consumers viewed a lower level of risk from everyday food than their urban counterparts did. As mentioned previously, a higher perceived control and stronger social ties in the rural region were the main reasons for the diversity in risk perception related to common foods between rural and urban region.

### 3.2. The determinants of consumer concern about food safety

Table 5 shows the results of PCA. Four retained components include risk perception of protein food, institutional trust, information acquisition about food safety incidents and risk perception of vegetables and fruits. They are potential determinants of the concern about food safety. They were unrelated and able to account for a majority of the total variance of the dataset. Risk perceptions of six common food products were not loaded in the same component, confirming that consumers perceived the risk of vegetables and fruits differently from that of protein food.

The Kaiser-Meyer-Olkin (KMO), a measure of sampling adequacy, was 0.754. The Bartlett's test of sphericity was significant at  $p < 0.000$ , suggesting patterned relationships among variables. Hence, the dataset was adequate for PCA. The Cronbach's Alpha of all the components were 0.7 or higher, suggesting the acceptable construct reliability (Tavakol & Dennick, 2011).

Table 6 presents results of the ordered logit regression model. The model fit is analysed below. The likelihood ratio chi-square was 82.76 with a p-value  $< 0.001$ . This suggests that the model with predictors as a whole was statistically significant, as compared to the null model with no predictors. In addition, the count  $R^2$ , a seemingly appealing measure of model fit (Long & Freese, 2006), yielded the value of 0.442. This means 44.2% of predictions were correct. Furthermore, the Likelihood Ratio test was performed to determine significant determinants of food safety concern. Four statistically significant predictors ( $p < 0.001$ ) were found (Table 6). Moreover, we tested the null hypotheses that the coefficient of “region” equals the coefficient of other significant independent variables. Via the Wald test, these hypotheses were rejected.

For simplicity, we only reported the marginal effect of the highest category of dependent variables: “extremely worry”.

None of the demographic variables was statistically significant, demonstrating that demographic characteristics did not determine the level of worry about food safety (Table 6). Some related research in developing countries for example, in China (e.g.,Liu et al. (2014)), in



**Table 5**

Principle component analysis for potential factors affecting the concern about food safety in Hanoi.

Source: Authors' own data

Observed variables and components	Factor loading	Variance explained	Cronbach's alpha
<b>Component 1: Risk perception of protein food (PerProteinFood)</b>		30.345	0.828
Risk perception of fish	.829		
Risk perception of milk	.816		
Risk perception of egg	.765		
Risk perception of meat	.650		
<b>Component 2: Trust in responsible institutions (Trust)</b>		17.749	0.813
Farmers	.844		
Food retailers	.801		
Local government	.789		
Central government	.738		
<b>Component 3: Information acquisition about food safety incidents (Inform)</b>		12.167	0.700
Food safety incident heard from social media (Facebook)	.799		
Food safety incident heard from relatives/friends	.743		
Food safety incident heard from TV	.739		
<b>Component 4: Risk perception of vegetables and fruits (PerVegFruit)</b>		8.037	0.762
Risk perception of vegetables	.708		
Risk perception of fruit	.661		
Total variance explained (%) = 68.29			
Kaiser-Meyer-Olkin (KMO) = 0.754			

**Table 6**

Ordered logit regression results for principle components and demographic factors affecting the concern about food safety.

Source: Authors' own data

Variable	Coefficient and Standard deviation	Marginal effect and Standard deviation
Age	0.007 (0.008)	0.001 (0.002)
Gender	0.078 (0.263)	0.015 (0.053)
Income	-0.008 (0.039)	-0.001 (0.008)
Education	0.007 (0.094)	0.001 (0.019)
Children	0.137 (0.202)	0.028 (0.041)
Region	0.530* (0.204)	0.107*(0.041)
ConcernIssue	0.132*(0.037)	0.027*(0.008)
FoodPoison	0.011 (0.178)	0.002 (0.036)
PerProteinFood	0.440*(0.092)	0.089*(0.017)
PerVegFruit	0.426* (0.089)	0.086*(0.017)
Trust	-0.060 (0.090)	-0.012(0.018)
Inform	0.332* (0.097)	0.067* (0.019)
Log-likelihood ratio = 82.76 (p = 0.000)		
Count R <sup>2</sup> = 0.4		

Note: \* denotes significance at the 5%-level; Standard errors in parentheses; Marginal effect were calculated for the category “extremely worry”; age = respondent's age; gender = 1 if male; income = natural log of monthly income; education = education level, ranged from 1(no schooling) to 6(postgraduate); children = 1 if having at least one child, region = 1 if urban; ConcernIssue = number of food safety concerned issues; FoodPoison = whether having been poisoned by food; PerProteinFood = Risk perception of protein food; PerVegFruit = Risk perception of vegetables and fruits; Inform = Information acquisition about food incidents.

Vietnam (e.g., Mergenthaler et al. (2009)) pointed out that among various demographic variables of consideration, only the presence of children in the household influenced consumers' perception of food hazards. More research is required to investigate the impact of demographic factors on food risk perception in Vietnam.

Interestingly, region was the most important determinant of food safety concern. Urban people tend to worry more about food safety than their rural counterparts. They were 10.67% more likely to report “extremely worry” about food safety than rural respondents. This result is in line with Verbeke and Viaene (2000), who reported rural consumers were less concerned about meat safety than urban consumers. Once again, the difference in perceiving food safety risk between rural and urban people can be explained by the effect of perceived control (Redmond & Griffith, 2004). In the rural region, perceived control of food safety was enhanced as a result of subsistence farming. With land

and labor available, nearly 90% of rural households surveyed produced their own food. As such, they had a strong belief that they were able to control the safety of their food.

*“What I buy from the market may be not safe, but at least, what I produce is safe. I can grow vegetables, fruit trees, raise chickens, ducks, and pigs for my family. We (rural people) produce many things and just buy some things we don't have from wet markets. Our food is absolutely safe.”* (The rural group)

During group discussions, not only rural but also urban participants frequently expressed their trust in home-grown food which was described as “absolutely safe”, as compared to food in the market. Acting of this belief, nearly 40% of urban households surveyed attempted to grow vegetables and fruits indoors. However, due to land constraint, they were unable to produce a range of food for their own family like rural families. Home-grown food in these urban households just accounted for a small proportion of the household food basket. The absence of home-grown food led to the lack of perceived control over food safety, and this thereby heightened urban consumer's concern about food safety.

The degree of worry about food safety was positively and significantly determined by information acquisition about food safety incidents. One unit increase in information acquisition would result in being 6.7% more likely to express an extreme worry about food safety. This finding supports previous research which shows the positive relationship between risk perception and information about food risk (Rutsaert, Regan, et al., 2013; Wachinger, Renn, Begg, & Kuhlicke, 2013). This relationship can be explained by the framework of social amplification of risk developed by Kasperson et al. (1988). Mass media and social media have played the role of “risk amplifiers” in Vietnam. Similar to Nguyen-Viet et al. (2017), we found that a massive volume of media coverage about food safety incident in Vietnam has accelerated consumers' risk perception. In addition, consumers were not well informed about food risk, as extensive and contradictory information was provided to them. Consequently, there is a confusion and distrust among consumers. This was confirmed through group discussions.

*“Watermelons were soaked in preservatives, said a lot by T.V. Watermelons for ancestor cult in the New Year festival did not rot for a whole year. If there were no preservatives, why it could last for so long? Apples, pears, dragon fruits, all are the same. Can we trust in fruit now?”* (The rural group)

*“There is too much and different information about food, I don't know*

who I should trust” (The urban group).

Trust in institutions that are responsible for food safety management has been empirically demonstrated as an important predictor of perception of food safety (risk) in a number of studies (Chen, 2013; Frewer, de Jonge, & van Kleef, 2007; Liu et al., 2014; Lobb et al., 2007). Surprisingly, in this paper, trust in institutions was not related to the worry about food safety. Perhaps, other factors rather than trust determine the concern about food safety or trust indirectly rather than directly influence the concern about food safety. More research in Vietnam is required to examine the influence of trust on risk perception in general.

Unexpectedly, direct experience with food poisoning did not determine food safety concern. Perhaps using survey questions to obtain information on food poisoning experience was not an appropriate data collection method. Firstly, food poisoning is not easily identifiable, especially when poisoning symptoms are not clear or being similar to other illness. Secondly, consumers might just remember their most recent and severe events. Thus, events that happened a long time ago and were not serious might be forgotten.

Risks perceived of common food were important predictors of the concern about food safety. The effect of risk perceived of protein food and risk perceived of vegetables and fruits on food safety concern were both statistically significant, positive and large. If the risk perceived of protein food items or of vegetables and fruits, increase by 1 unit, the respondent would be 8.9% and 8.6% more likely to report an extreme worry about food safety, respectively. Hence, from a policy perspective, to reduce consumer worry about food safety, risk perception of common food must be reduced.

Number of food safety concerned issues was another determinant of the concern about food safety. This suggests that reducing consumer anxiety about food safety requires effort in managing food hazards and in reducing the risk perception of hazards. Moreover, there exists a dearth of research that investigates the relationship between risk perceived of common food, risk perceived of hazards and the concern about food safety, thus, more research on this issue is needed.

#### 4. Conclusions and policy implications

Using a consumer survey and group discussions, we found that food safety was a primary concern for a vast majority of food shoppers in Hanoi. Consumers worried about various food hazards, particularly chemical hazards that were perceived to be invisible, having long term effects and serious health consequences. Hence, in their eyes, a high risk was involved in several common food categories that can be easily contaminated by chemical hazards. This suggests relationships between risk perception of hazards, risk perception of common food and the worry about food safety. Therefore, to address “food fears” in Vietnam, these relationships must be considered. The concern about food safety can be lessened by reducing risk perception of common food and risk perception of hazards, particularly chemical hazards.

The study shed more light on regional differences in food safety concern. The concern was lower in the rural region due to a higher perceived control over food safety and stronger social and kinship networks that are typical in the rural setting. In rural areas, such perceived control was gained through an integrated farming system including garden, fishpond, and animal husbandry which enable small-scale farmers to produce a range of “safe food” for family consumption. Reducing food safety worries in urban region requires an improvement on personal perceived control over food safety. This can be done through the development of urban farming.

The concern about food safety was determined by number of food safety issues that caused the concern, risk perceived of protein food, and risk perceived of vegetables and fruits. The strong effect of risk perceived of common food products on the concern about food safety draws an important policy implication. To eliminate consumers’ concern about food safety, policy interventions should focus on reducing

the risk perceived of common food products in Vietnam, especially products that were considered to be risky such as vegetables, fruits, and meat. To do so, a better control of the safety of these products is required.

The moderate effect of information acquisition about food incident highlights the importance of risk communication in Vietnam. Risk communication is poor in Vietnam (Nguyen-Viet et al., 2017). Excessive and conflicting information about food risk expressed by media is responsible for consumers’ confusion and distrust. Hence, the concern about food safety is growing. There is a need to manage food risk communication, aiming at information provision which is accurate, evidence-based, and balanced between risk and benefit. In addition, capacity building through consumer education program which focuses on food hazards would support consumers’ decision making in reducing risk. Finally, better management of chemical inputs would substantially alleviate consumer’s distrust in food.

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#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodcont.2018.11.031>.

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