UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE

CONSUMERS' WILLINGNESS TO PAY FOR SAFER VEGETABLES IN OUAGADOUGOU, BURKINA FASO

ADINAN BAHAHUDEEN SHAFIWU

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BY

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THESIS SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS, FACULTY OF AGRIBUSINESS AND COMMUNICATION SCIENCES, UNIVERSITY FOR DEVELOPMENT STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN AGRICULTURAL ECONOMICS

2017

DECLARATION

Student

I hereby declare that, this thesis is the result of my own work and to the best of my knowledge, it contains no material previously presented for the award of any other degree in this university or elsewhere except where due acknowledgement has been made in the text.

Candidate's Signature:…….. Date:…….

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We hereby declare that the preparation and presentation of the thesis was duly supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies:

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ABSTRACT

This study assesses consumers' willingness to pay (WTP) for safer vegetables in Ouagadougou, Burkina Faso. A semi-structured questionnaire was administered to 350 vegetable consumers selected through a multi stage sampling procedure from ten districts of the capital city, Ouagadougou. Descriptive statistics was used in identifying the mean Willingness to Pay (MWTP). Ordered probit and Multinomial logit were used to estimate the factors influencing consumers' WTP and consumers' preferred purchasing outlets of safer vegetables respectively. The Garrett ranking technique was then used to rank the constraints to accessing safe vegetables. The results revealed a very high (98.6%) WTP for safer vegetables. The mean WTP amounts for the three selected vegetables if safer were CFA 322(GH¢ 2.3), CFA 400(GH¢ 2.8) and CFA 265(GH¢ 1.9) for 1.5kg of cabbage, 1kg of a bundle of lettuce and 1kg of tomatoes, representing 63.5%, 100% and 59.0% increment. The results also indicated that consumers' income, education, household size, and health concern significantly influenced their WTP for safer vegetables. Also, household size, occupation, education and respondents' knowledge on the existing vegetable markets significantly influenced consumers' choice of preferred market. With respect to the constraint to accessing safe vegetables, inadequate supply of safe vegetables was ranked first while cultural barriers were the least ranked constraints by consumers. Based on the findings, the study recommends that stakeholders should venture into production and selling of safer vegetables. Also there should be keen efforts by stakeholders to create consumer awareness about the health implications of consuming safer vegetables.

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DEDICATION

This work is dedicated to my dear parents Hajia Lawuratu Abukari and Alhaji Shafiwu Yorimah.

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ANOVA	Analysis of variance
CUSUM	Cumulative Sum
CVM	Contingent Valuation Method
CV	Coefficient of Variation
CE	Choice Experiment
CM	Choice Modeling
DB	Double Bound
DF	Degrees of freedom
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GM	Genetically Modified
HPM	Hedonic Pricing Method
INSD	Institute *de* National *de* Statistics Department
LRT	Likelihood Ratio Test
ML	Maximum Likelihood
MoFA	Ministry of Food and Agriculture
MRA	Moderate Regression Analysis
MWTP	Mean Willingness to pay
NPCs	National Product Classification for Services
OLS	Ordinary Least Squares

PPO	Preferred purchasing Outlets
SSA	Sub-Saharan Africa
UPA	Urban and Peri Urban Agriculture
UNDP	United Nation Development Plan
US	United States
WHO	World Health Organization
WTA	Willingness to Accept
WTP	Willingness to pay
WTO	World-Trade-Organisation
WTU	Willingness-to-use

CHAPTER ONE

INTRODUCTION

1.0 Background of the study

Globally, there is a remarkable increase in consumers' demand for vegetables partly due to urbanisation (see Renaud *et al*., 1995 and Yahaya, 2008) and the general belief that, vegetables contain vitamins and minerals that contribute to good health and vitality (WHO, 2013). A minimum amount of daily vegetable intake of 400g is recommended for the purpose of good health and vitality (WHO, 2013).

In Africa, vegetables are part of the daily diets found in soups and sauces accompanied by carbohydrate staples (Smith and Pablo, 2007). From the World Health Organisation's initiative on consumption of vegetables and fruits, a frame work to promote availability and access, and adequate consumption of vegetables was developed. The framework serves as a guide in the development of a cost-efficient and effective intervention for the promotion of sufficient consumption of vegetables both at the national and sub-regional levels (WHO 1989, 2006).

In West Africa, the consumption of vegetables from the wild or from home gardens is important for the nutrition of both the rural and urban populations in arid and semi-arid areas (Mertz *et al.,* 2011).

In a wider perspective, the concept food safety consists of a wide matrix of issues affecting the food system, ranging from basic commodity production and processing to retail marketing and international trade (Antle, 2001). The utilisation of inputs including fertilisers and pesticides for crop production, and feed and drugs for animal agriculture

were identified as issue of food safety concern (Antle., 2001). The concept of safer vegetables from the implication of health and public policy stresses food processing to create food safety risks.

The term food safety is also inextricably linked to the nutritional qualities of food, a wider range of concerns about the properties of unfamiliar foods and the tendency of not contracting a disease due to the consumption of a certain food (Ngigi *et al.*, 2011). The term is also emphasised to be a quality characteristic that cannot be easily observed and measured with its opposite being food risk or unsafe food (Wang *et al.*, 2014).

Similarly, the concept food safety can be distinguished from objective and subjective views. Objective view of food safety is a concept based on assessment of the risk of consuming a certain food by scientists or food experts while subjective view of food safety is in the mind of the consumer (Ngigi *et al.*, 2011).

Safer vegetables is recognised as those that are organic, tested and certified, they are free from pesticide residues that are harmful to human well-being (Akgungor *et al.*, 2010).

Nutritionally, vegetables are a vital source of protective food containing vitamins and minerals. Any balanced diet should include vegetables for this reason. The term 'vegetable' can be used to mean the tender edible shoots, leaves, fruits and roots of plants that are eaten whole or part raw or cooked and adds to starchy foods and meats (Williams *et al*, 1991; Abdulai, 2006).Vegetables differ from field crops by the fact that, vegetables are harvested when the plant is fresh and high in moisture while the field crops are harvested at the mature stage for their grains, seeds, roots and fibre. The proportion of vegetables required in a balanced diet per capita per meal is of the order of 45% of the

total volume of the food. Vegetables supply considerable quantities of vitamins A, B, C, D, E and K (Abdulai, 2006).

The economy of Burkina Faso is dominated by agricultural activities and employs more than 80.0% of the total population (INSD, 2013). The sector's contribution to GDP is about 40.0%, with crops accounting for 25.0%, livestock 12.0% and forestry and fishing 3.0% compared with 19.1% and 42.7% for the secondary sector (Manufacturing, trade) and tertiary sector (services) respectively, which are the main sources of the country's economic growth, (INSD, 2013).The country's agriculture is subsistence and mainly into cultivation of cereals such as: sorghum, millet, maize, and rice. Cereal cultivation constitutes about 88.0% of the total land cultivated area per year (INSD, 2013). The major export crop is cotton which provides on the average 50.0% of export income.

The development of the agricultural sector of the country is hampered by major natural constraints, soil degradation and climatic factors (INSD, 2013).The country is part of the least developed countries in the 2014 world country classification of Gross Domestic Product (GDP) and ranked number 181 out of 187 countries under the United Nations Development Programme (UNDP) Human Development Index, with an average annual per capita income between 230 and 250 US dollars compared with 500 US dollars in Sub-Saharan Africa (UNDP, 2015).

Tomatoes and lettuces are the two most commonly produced and consumed vegetables in Burkina Faso. However, their cultivation involves the use of pesticides (Gerken, 2001; Lund *et al*., 2010; Williamson *et al.*, 2008; and Amadu *et al.*, 2014) and unsafe irrigation water (Amadu *et al*., 2014).Thus, the production of these two vegetables in Ouagadougou

stands a high chance of being contaminated. In addition, while tomato is the main primary market oriented vegetable (Mathieu *et al.,* 2006), lettuce production is also on commercial basis with both dry and wet seasons production, representing 51.4% (Bellwood-Howard *et al.,* 2015).Though cabbage production and its consumption is less compared to the other two vegetables, its production undoubtedly is without pesticides and contaminated water (INSD, 2013). Thus the reason for the study, so as to establish consumers' willingness to pay more for the three most produced and consumed vegetables when produced with clean irrigation water, free from pesticide and sold at a clean environment.

1.1 Problem Statement

The Global Forum of Food Safety Regulators by the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) on the theme **"**improving efficiency and transparency in food safety systems - sharing experiences in 2002**"** recognised food safety as a shared responsibility for everyone in the food chain across the world. Since then, debates and discussions about food safety issues in both developed and developing countries have been a matter of concern (Sherrow, 2008). A question that still lingers in the minds of many people is "whether current food production practices, especially in Urban and Peri-urban Agriculture (UPA), can be altered to ensure food safety". The potential to achieve food safety exists because recent studies have confirmed that with increasing per-capita incomes in countries, and as cities become more urbanised, dietary needs change and people become more health conscious, so they tend to demand safer foods (Annan-Peprah *et al.,* 2012; Tian and Yu, 2013; Mergenthaler *et al.,* 2009; and Arnoult *et al.*, 2015).

Regulations on pesticide and fertiliser residue usage in farming systems exist in most developing countries which Burkina Faso is not an exception. However, strict enforcement by public institutions on their usage is generally not satisfactorily (Youdeowei, 1989; Akhtar *et al.*, 2014). Prominent features of Urban and Peri- Urban Agriculture (UPA), such as high demand for vegetables in cities, higher profit from vegetable farming and the inability of many vegetable consumers to differentiate between vegetables produced with clean water or waste water, have enabled farmers to rely on every "cheap or unsafe means of production" to claim their gains (Yahaya *et al.*, 2015). This has raised major concern and thus calls for the need for production of safer vegetables.

However, a number of studies (Batte *et al*., 2007; Poole *et al*., 2006; Liu *et al.*, 2009) have been conducted on willingness to pay (WTP) for food quality and safety. Though there exists literature on how much consumers are willing to pay for safer food (Blend and Ravensway 1999; Gao and Ted, 2009), literature has not extensively examined vegetables in Burkina Faso, particularly Ouagadougou, to the best of the researcher's knowledge.

Also, the continuous use of untreated waste water as well as agro-chemicals has raised key health concerns and the need for the production of safer vegetables. This means farmers may need to produce with clean water and under strict regulations or use methods that avoid food contamination. This comes at an extra cost, which must partially or wholly be borne by the end-users (consumers).Whether consumers are willing to pay for this extra cost or not is an empirical question which this study sought to answer.

Many studies (eg Blend and Ravensway 1999; Gao and Ted, 2009) identified factors influencing consumers' willingness to pay as a marketing strategy in meeting the needs of customers (consumers), but it is not always clear whether they understand the needs and expectations of the customers (consumers) they serve, hence the quest to determine the factors that, influences the decision of "Ouagalais" to pay for safer vegetables.

Also, more often than not, smallholder farmers are faced with the challenge of significant exclusion from international market supply chains and thus, rely on the domestic market. These smallholder farmers (vegetable producers and/or marketers) are not organised, hence they vary their prices based on the purchasing point/ outlets. However, the literature gap that exists in this area is the inadequate evidence on how consumers' socioeconomic characteristics affect their preference for purchasing point/outlets for safe vegetables and its implications for market targeting, hence the quest to empirically determine the factors influencing consumers' preferred purchasing outlet/points in Ouagadougou, Burkina Faso. This study therefore contributes to filling these gaps by asking the following research questions:

1.2 Research Questions

Main Question

Mainly, the study finds out if consumers were willing to pay for safer vegetables in Ouagadougou, Burkina Faso.

The following sub-questions were also raised to address or answer the key question.

1. Are consumers willing to pay for safer vegetables in Ouagadougou, Burkina Faso? If yes how much?

2. What are the factors influencing consumers' willingness to pay for safer vegetable in Ouagadougou, Burkina Faso?
3. How do consumers' socioeconomic characteristics affect their preferences for shopping outlets/points of sales for safer vegetables in Ouagadougou, Burkina Faso?
4. What are the constraints to consumers in accessing safe vegetables in Ouagadougou, Burkina Faso?

1.3 Objectives of the study

General objective

The main objective of this study is to assess consumers' willingness to pay for safer vegetables in Ouagadougou, Burkina Faso.

The specific objectives of the study were to:

1. Investigate whether or not consumers were willing to pay for safer vegetables in Ouagadougou, Burkina Faso; and if yes determine how much they were willing to pay.
2. Explore and analyse the determinants of consumers' willingness to pay for safer vegetable in Ouagadougou, Burkina Faso.
3. Determine how consumers' socioeconomic characteristics affect their preference for purchasing outlets/ point of sales for safer vegetables in Ouagadougou, Burkina Faso.
4. Determine and rank the constraints consumers' may face in accessing safe vegetables in Ouagadougou, Burkina Faso.

1.4 Justification of the study

The main motivation for the study stems from the belief that, increase in public concerns on food safety issues such as the use of fertilisers, pesticide residues, growth hormones, genetically modified (GM) organisms (Michael *et al*., 2009,; Rimal *et al*., 2005) has increased the demand for environmentally friendly products. Also, the concern of governments about diet and health and the renewed recognition of the role of public policy in promoting healthy diets, has motivated this study (Poole *et al*., 2007). According to Fraser (2005), the nutrition transition towards unhealthy diets, which is occurring at a faster rate in developing countries than developed countries, is a global problem which must be addressed.

The study differs from others in that, in developed countries, some studies (Batte *et al*., 2007; Poole *et al*., 2006; Liu *et al*., 2009) have estimated consumers' willingness to pay for safer vegetables and in developing countries, others (Akgüngör *et al*., 2007; Lacaze *et al*., 2009; Mergenthaler *et al*., 2009 and Lippe *et al*., 2010), have examined consumer valuation on food safety production processes , yet none has looked at the preferred purchasing outlet and its determinants and the constraints in accessing safe vegetables, to the best of the researcher's knowledge.

Also, globally it is estimated that over 20 million hectares of vegetables are cultivated with contaminated water (Nabulo *et al*., 2008) resulting in negative effects for human health risk. Thus, a study on consumers' willingness to pay for safer vegetables would be useful in addressing health concerns of the consumers and help contribute to the management of public health costs (Michael *et al*., 2009).

Also, consumers' knowledge and attitudes toward safer foods should help in formulating regulations that ensure the safety of the food supply. The identification of factors influencing consumers' WTP and preferred purchasing outlet for safer vegetables would provide useful information in formulating short and long term marketing programmes. In addition the outcome of the study would benefit both the Government of Burkina Faso and NGOs in their policy making towards irrigation farming.

1.5 Organisation of the study

The study is organised into five chapters. Chapter one provides the introduction, problem statement, objectives and justification of the study. Chapter two gives an overview of literature relevant to the study. It examines literature on Willingness to pay, Contingent valuation method and purchasing point/outlet for safer vegetable. Chapter three outlines the methodology of the study. In particular, it describes the study area, sampling techniques and size and model specifications. In chapter four, the descriptive and inferential results of the study are presented followed by discussions of the results obtained. Finally, chapter five summarises the findings, draws conclusions based on the findings and makes recommendations based on the conclusions.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature on agriculture and farming systems in Burkina Faso, as well as the theoretical concepts and empirical findings related to the study. Theoretically, the concept of food safety, waste water usage in vegetable cultivation, environmental valuation methods, willingness to pay and willingness to accept are reviewed. Also, empirically literatures on the socio-economic variables affecting WTP and preference for purchasing point/ outlets are reviewed. The chapter ends with highlights from the various reviewed literature.

2.1 General overview of agriculture and farming system of Burkina Faso

Burkina Faso is an agrarian country and employs more than 80.0% of the country's population in the agricultural sector (INSD, 2013). The country is faced with food insufficiency, thus making the government to provide agricultural policy such as (food for all by 2020) aimed at encouraging off-season agriculture by integrating the market gardening in a set of programmes in 2003-2004. The policy (food for all by 2020) was aimed at allowing the dominant peasant farmers to satisfy the food needs of the population by increasing the hectares of land cultivated per year (INSD, 2013).

In Burkina Faso, agriculture is almost exclusively extensive. It is mainly practiced on about 800,000 small scale family farms of three to six hectares (INSD, 2013). It is mainly food crop agriculture with low productivity and dependent on the vagaries of climate. In these conditions, crop production can hardly satisfy food needs and guarantee food self-

sufficiency. The main crops grown are vegetables and fruits, cereals, legumes and tubers, and cash crops.

Vegetables and fruits: The main vegetables and fruits grown are tomatoes, onions, cabbage, okra, green beans, potatoes, mangoes, citrus and bananas. Tomatoes are still the primary market-oriented vegetable, but production is hampered by some post-harvest problems such as packaging, stocking and transportation. Traditionally, the main domestic production of vegetables in Burkina Faso is the vegetable gardens; this is however losing its importance due to urbanisation (Millogo *et al*., 2002). Market gardening is practiced in large irrigation schemes but also in small individual vegetable gardens. The latter generates extra income for farmers and this has positive effects on the trade balance. Only green beans and mangoes are exported to the European Union.

***Cereals*:** It accounts for nearly 88% of the annual cropped area (Millogo *et al*., 2002). In order of importance, these are sorghum (white and red), millet, maize, rice and fonio. Cereal crops are mainly rain-fed and are therefore exposed to the climatic risks and the continuous degradation of the soils and environment. Rice is the principal irrigated cereal. Recently, the government has been promoting small scale irrigation in the dry season for maize and cowpeas (*niébé*). Because the population depends on cereals as the staple food, Burkina Faso imports more or less significant quantities of cereals. For instance, 50% to 60% of rice is imported yearly (Millogo *et al*., 2002)

Legumes and tubers, mainly cowpeas, bambara groundnuts, sweet potatoes, yams and to a lesser extent, cassava. They are grown on a very small percentage of the land (2.0% of cultivated surfaces in 2002–2003) (Millogo *et al*., 2002).

Cash crop: The main export crops are cotton, sesame, groundnuts and soybeans and uses only 12 % of the annual sowed surfaces (Millogo *et al*., 2002)

2.2 Review of theoretical Concepts

2.2.1 Food Safety

Food safety is an important concept in public health as recounted by National Research Council (1993) and Steahr (1996a, 1996b) cited in Antle (2001). It is particularly relevant to vulnerable segments of the population such as the elderly, pregnant women, young children, and the immuno-compromised.

Wang *et al.* (2014) emphasised that the concept of food safety is a quality characteristic that cannot easily be observed and measured. Coulibaly *et al*. (2011) indicated that, an understanding of safer vegetables should capture such quality attributes as damage free, freshness, size and colour of vegetables. Chen and Chai (2010) earlier accented this understanding indicating that the concept of green products should be conceived as environment-friendly or ecological products. Green foods are defined as foods that are safe enough to consume, are of fine quality and are nutritious food products that focus on sustained improvement in the eco-environment and coordination among the social, economic and eco-environmental efficiency (Liu, 2003).

Furthermore, Elkington *et al* (1988) indicated that, though green foods can be organic, it is not a necessary condition for defining all organic foods. They concluded that, green foods should be considered as foods that supplement health when consumed, should be produced with little chemicals, have broader concerns with food safety and the environment, and maintain consistently high standards of animal rearing (health and

welfare) than conventional foods. Green foods are therefore safe and hence, food safety and green foods are synonymous.

Earlier works by the National Research Council in USA (1987b, 1993) cited in Antle (2001) viewed food safety from a broader perspective as a term that consists of a wide matrix of issues affecting the food system, ranging from basic commodity production and processing to retail marketing and international trade. At the fundamental level, the quality of soil and water used in crop and animal production can result in food safety concerns, especially when water-borne diseases are transmitted through irrigation water or when chemical contaminants in soil or water accumulate in crops or livestock. Another key category of food safety issues, they noted, is related to the utilisation of inputs including fertilisers and pesticides for crop production, and feed and drugs for animal agriculture. Pesticides have taken the centre stage in public concerns and regulatory activities due to their high toxic content which pose serious threats to human health with far reaching effects such as cancer among other diseases.

Antle (2001) therefore recounted the concept of safer vegetables from the viewpoint of health and public policy implications stressing that food processing may create food safety risks. Processed foods contain significant contents of chemical residues; pathogens in animal excreta may be introduced into ground meat so that they pose acute health implications to consumers than they would if the meat were consumed in larger cuts such as steaks. Preservatives that may cause a health risk are added to many foods. Consequently, physical hazards such as glass or metal shards may be encountered in the processing.

Goldberg and Roosen (2005) emphasised that consumers have frequent food safety seeking behaviour and are willing to pay a higher price for nutritive products that are of good health to their body. This is attributed to the fact that consumers increase their utility level by minimising health risks at the same time. They however noted that some of these health risk benefits are tedious to estimate. A commonly adopted analytical method to examine food safety benefits is computing willingness to pay for safer and good-quality food.

Akgungor *et al.* (2010) defined safer vegetables as those that are organic, tested and certified, free from pesticide residues that are harmful to human health. Earlier work by CIRAD (2003) revealed that consumers from mostly European countries value external characteristics and observe attributes such as free from damage, freshness, size, and colour, in assessing vegetable quality. In particular, red colour is preferred for tomato, however some consumers believed more colour in tomatoes is an indication of artificial maturation from chemicals or induced with fertiliser for early maturity. In the same vein, a tomato that is too large could imply that the farmers adopted growth-stimulating chemicals. Given these worldviews, more consumers may choose pink and smaller tomato fruit.

The term ‘organic food’ has also been used frequently among Spanish households to mean safer vegetables. Gil *et al.* (2000) noted that, Spanish consumers mostly perceive fruits and vegetables that are produced in subsistent quantities in family gardens in rural areas as being safe and of good quality. Heaton (2001) alluded to the fact that organic foods are healthier than conventional foods and contain less harmful additives but equally basic (e.g. dry matter, vitamin C, minerals) and secondary nutrients (i.e., phyto-nutrients)

than conventional foods. In other words, organic foods do not carry along additional risk of food poisoning.

A review of the key issues and leading works in the field of food safety by (Batte *et al*., 2007; Poole *et al*., 2006; Liu *et al*., 2009) shows some consistencies in the meaning of the concept as there is a general consensus from the authors' views that for food to be safe it should be green, organic and healthy. It is interesting to note that, even though there exist a wide range of key papers and case studies in the area, a very strong emphasis has been on the developed world. In the developing world, studies have not extensively covered the issues ranging from the meaning, the rules and standards on safe vegetable production.

2.2.2 Importance of quality attributes of vegetables to buyers

Some developing countries are gradually becoming environmentally cautious about food. For instance, Mohamed *et al.* (2014) revealed that the Malaysian government introduced the Environmental Quality Act in 1974, intended to prevent, abate, and control pollution as well as improve the quality of the environment in the country. The Department of Environment has been committed to enforcing this legislation to ensure Malaysia maintains a healthy living environment alongside its industrial growth.

Coulibaly *et al.* (2011) attested to the fact that some acute health hazards may arise from misuse of chemical pesticides applied in vegetable production. Minimising health risks by developing alternatives to synthetic pesticides may be beneficial for consumers and producers so as not to compromise on the vegetable quality attributes. The danger to consumers from consumption of vegetables with significant levels of synthetic pesticides

is high because they are unaware of the health implications associated with chemical residues in vegetables (Coulibaly *et al.,* 2002).

According to Hendrik and Recke (2000), there is rising concerns regarding safety aspects of synthetic pesticides and driving public awareness and desire for information on misuse of synthetic pesticides and for assessment of alternative pest control methods. Non-governmental organisations are supporting implementation of integrated pest management (IPM) strategies in Ghana. Changes in production conditions (growing plot sizes, expanding mono-cropping, reduction in fallow periods) need to be compensated for with appropriate changes in cropping techniques such as effective crop rotation and use of inputs including IPM.

The World Bank supports pest control strategies that promote the use of biological or environmental control methods (Youdeowei, 2000). The European Union (EU) has undertaken a programme for norms and standards and setting the maximum residual levels for chemicals suitable for use on agricultural products.

Most Chinese consumers are aware of the green food in China and 60% of them believe that green foods are more expensive than conventional foods and the majority of the households are familiar with green foods (Xia and Zeng, 2009). This suggests that vegetable consumers may compromise on quality attributes of green foods as a result of the price variations. According to Ngigi *et al.* (2011), quality attributes such as sensory attribute, convenience, safety and ethics are not separable among different market segments; therefore pulling the sample without taking into account difference in sample characteristic will not produce any biases.

A few articles explore the health implications of wastewater use in vegetables production to consumers in developing country (notably Hendrik and Recke (2000)). Further studies are therefore needed to see farther and understand better the vegetable quality attributes of priority to consumers and when and why consumers sometimes disregard certain quality attributes.

2.2.3 Consumer behaviour and vegetable consumption

Consumer buying behaviour from the view point of Lancaster (2001), is made up of activities that involve buying and using a product or service for personal and household use. Income is not the only determinant of the value consumers place on food but there are several other influencing factors; both external and internal attributes, used by consumers to perceive a product quality. These attributes are described to have influence on consumers' purchasing motive.

A study by Oboubie *et al*. (2006) in Ghana revealed that, in buying vegetables, consumers look for characteristics such as freshness, colour and spotless leaves. In Vietnam, supermarkets expansion had impact on consumers' demand for fruits and vegetables. The demand for products from modern supply chains, especially modern retailers and non-traditional imports is highly income elastic (Mergenthaler *et al*., 2007).

According to Kovacic *et al*., (2002), the people of Croatia mostly consider vegetable freshness and sensory intrinsic attributes such as taste when buying vegetables. Combris *et al*. (2007), in trying to get answers to whether taste beats food safety, found that food safety instantly influenced consumers' willingness to pay while taste was preferred to the guarantee of food safety in buying behaviour.

Individuals' values are developed through socialization and these differ from one culture to the other, thus making specific cultural values to reflect in the specific consumer behaviour (Reuters *et al*., 2006).

2.3 Waste or contaminated water and vegetable production

Wastewater has been the main source of water used during the dry season for urban agriculture in many developing countries especially in Africa. The increase in population and its related increase in demand for food in the growing urban cities account for the increase in the use of wastewater. The increasing urbanisation in developing countries results in the generation of high volumes of wastewater (IWMI, 2004). In these urban cities especially in arid and semi-arid countries, waste water generation is all year-round, inexpensive and a good source of nutrients for urban and peri-urban vegetable producers (Buechler *et al.*, 2002; Van der Hoek, 2003). Wastewater is globally becoming a vital resource, especially in urban and peri-urban agriculture (Buechler *et al.*, 2002).

According to Van der Hoek (2003), the uses of waste water in urban and peri-urban agriculture are enumerated below:

- Direct use of untreated wastewater; wastewater taken directly from the sewage systems and/or drains that carry large sewage flows for irrigation
- Reclaimed water; it refers to wastewater that is treated and conveyed through a controlled exit from the point of treatment works to a controlled area where it is used for irrigation purposes; and
- Indirect use of wastewater; with this, industrial and domestic wastewater is discharged into water bodies without any form of treatment or monitoring.

Figure 2.1 shows water can be obtained from water bodies and are used either treated or untreated for agricultural purposes and for urban domestic as well as industrial purposes. For the agricultural usage, the water obtained is used both directly and indirectly in either treated or untreated form. The agricultural usage of water in either treated or untreated forms comes with a lot of benefits as well as problems.

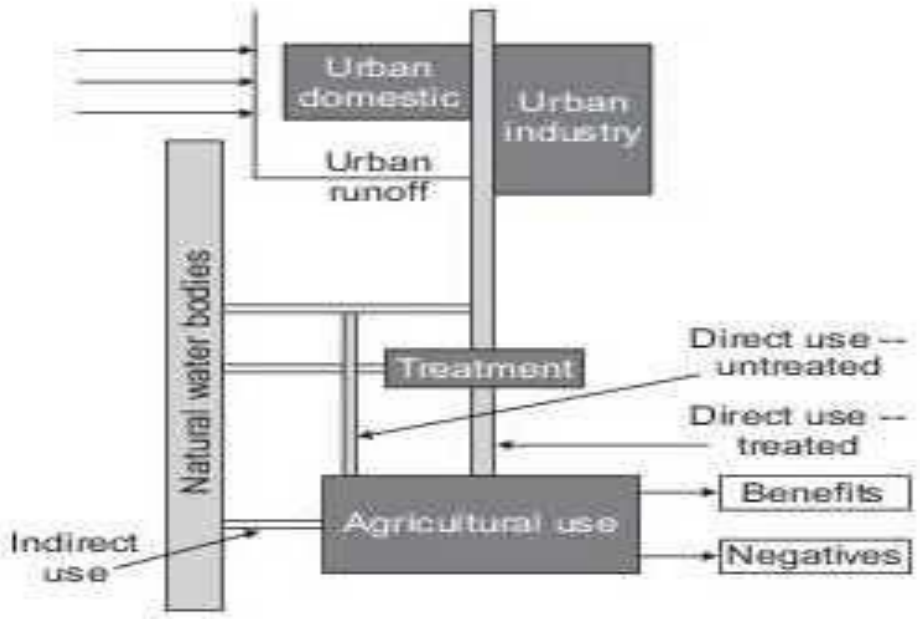

Figure 2.1: *Basic uses of wastewater*

Source: van der Hoek, (2003)

2.4 Environmental Valuation Methods

The main focus of environmental valuation is to attach monetary values for non-marketed environmental goods and services so as to adjust their values into economic decision making processes (Dixon, 2008). Environmental valuation is mainly based on the

assumption that individuals are willing to pay for environmental improvements and, conversely, are willing to accept compensation for some environmental deterioration.

In the literature, a number of market and non-market-based techniques are available to value the environment. Generally, environmental valuation methods can be put into two main categories: revealed preference (or indirect) approaches and stated (or expressed) preference (or direct) approaches (Dixon., 2008).

2.4.1 Revealed preference methods

Revealed preference involves the exploration of people's preference as revealed by their actions in markets, which are significantly related to the non-marketed value of an environmental good under consideration. In this method, we observe a real choice in some markets and vividly infer information on the trade-off between money and the environmental good (Kolstad, 2000). Some of the methods include travel cost method (TCM) used for the estimation of the use value of recreational sites and hedonic pricing method (HPM), which has been mostly used to estimate pollution costs. Often, TCM and HPM are unlikely to estimate non-use values because of their dependence on the actual market situation (Bennett and Blamey, 2001).

2.4.2 Stated preference methods

A stated preference method is used to elicit environmental values directly from respondents by asking them about their preferences for a given environmental good or service. This method considers environmental gains as an improved scenic view, better levels of air quality, or water quality and seeks to value or measure the monetary value of those gains directly (Pearce and Turner, 1990). The main idea behind the use of any stated preference technique for estimating non-market environmental values is to

quantitatively measure a person's willingness to bear a financial impost in order to achieve some potential (non-financial) environmental improvement or to avoid some potential environmental harm (Bennett and Blamey, 2001).

The main motivation for the use of stated preference methods is its capacity to produce estimates of the full array of use and non-use environmental benefits and costs. The most commonly used stated preference methods are contingent valuation method (CVM) and choice modelling (CM) or choice experiment (CE) method.

2.4.2.1 The Contingent Valuation Method (CVM)

Though, there are several economic methodologies to value nonmarket goods, researchers mostly consider Contingent Valuation the most appropriate for measuring food safety. The method is relatively low in cost and flexible compared to other methods that try to hypothesise real purchasing situations, such as experimental markets.

The theoretical background within which CVM works is from the Cost-benefit analysis. CV was originally proposed by Davis (1963) and basically used for non-market valuation (Hanley and Spash 1993: 53).

CV allows a direct estimation of WTP by means of different (direct) elicitation techniques. In CV, consumers are expected to simply indicate their WTP without purchasing the (nonmarket) hypothetical product. The major problems associated with this method are that, consumers may have less information about the product and its associated risks or benefits and therefore may give a wrong monetary evaluation of the benefits from risk avoidance. A possible remedy is by informing consumers about the risks involved during the interview or the experiment (Buzby *et al.*, 1995; Fox *et al.*,

1995). In this regard, the content of a contingent valuation survey was divided into three parts by Mitchell and Carson (1989) as follows:

1. A detailed description of the good being valued and the hypothetical circumstances under which it is (they are) made available to the respondent;
2. Questions which elicit respondents' WTP for the good (s) being valued ; and

3. Questions about respondents' characteristics (e.g. sex, age, income, education), their preferences relevant to the good(s) being valued, and their use of the good(s).

Since the elicited values in this approach are contingent on particular hypothetical market of the good (vegetable) described and explained to the respondents, it is termed the contingent valuation (Carson *et al.*, 2003).

The total value of the resource is determined by averaging respondents' values and extrapolating it across the population. This is an open-ended contingent valuation format. It has however been argued that, respondents often find it a difficult task to assign an appropriate value to the resource on their own. This often leads to a wide range of responses in a survey or a study by survey. Contrary to the open-ended format is the close -ended format of contingent valuation. This is a discrete or dichotomous choice question where respondents are presented with a value and are asked to either respond 'yes' if they would pay that amount or 'no' if otherwise. This typically mirrors the choices consumers face in an actual market of a commodity, where the commodity has a price and they either buy the commodity at the going price (yes) or they don't (no).

Other elicitation techniques exist. The choice of an elicitation technique however, depends on the type of resource being valued and the nature of the sample. Among the common elicitation techniques are:

The iterative bidding game format: The bidding game was first used by Davis in the early 1960s. This elicitation technique involves taking the respondent through a series of bids until a negative response is generated and a threshold established. There is a starting bid given by the interviewer to which the respondent either agrees to pay (or accept) or disagrees. The interviewer keeps increasing the bid till the respondent answers 'no' to it or keeps decreasing the bid till the respondent answers 'yes' to it. The latest bid to be accepted represents the respondent's highest WTP (or minimum WTA). There is a starting point bias in this technique. The situation whereby the starting bid suggested by the interviewer has the potential to ultimately influence the respondent's final bid is what is termed as a starting point bias (Dixon, 2008).

The payment card format: This format was developed by (Carson *et al.*,1984) as an alternative to the bidding game. This format asks respondents to choose from a range of values which best suits their maximum WTP. This approach doesn't provide a single starting point and thus eliminates the starting point bias as found in the bidding game. However, biases may arise as a result of the ranges used on the cards.

The discrete choice format: The discrete or dichotomous choice format is what may be known also as the take-it-or-leave-it format or the referendum format developed by Bishop and Heberlein in 1979. This approach asks the respondent to either agree or disagree to an amount stated by the interviewer. The amounts given are varied across the sample. These are what most consumers in the developed world face in actual markets and hence, are familiar with this system. This is also called the single bounded dichotomous choice. This method makes the respondents' task easier similar to the bidding game but this excludes the iterative process component of the bidding game. As

noted by Botchway (2011), the disadvantage with this method is that more observations are required for the same level of statistical exactness in a sample estimate.

The discrete choice with a follow up approach: This approach requires respondents to answer 'yes' or 'no' to a given amount on a particular good/resource regardless of their preparedness to pay for it . When a respondents says 'yes' a follow- up question with a higher amount is asked while a 'no' response is followed up with a question of a lower amount. The significance of this survey approach is its efficiency, but it has the limitations of the discrete choice technique.

Some of the biases that are likely to be observed in the use of CVM as a valuation technique are discussed below.

Starting point bias: The starting point bias arises when the starting bid given by the interviewer goes to ultimately influence the final response given by the respondent. This bias is best minimized by varying the starting bid among the sample. This way, the interviewer is able to investigate the influence of the starting bids on the final WTP.

Strategic bias: This bias arises when respondents deliberately understate their WTP or overstate their WTA. Sometimes also, WTP may be overstated especially if the respondents are aware that they will not be asked to pay for the resource but their responses are merely being used to get a value for the resource after which the government will provide the good. Respondents are likely to overstate their WTP if they want the good provided or may understate it if they do not want the resource provided. A discrete choice format where 'yes' or 'no' responses are required for differing amounts within the sample may minimize this bias.

Hypothetical bias: Hypothetical bias results from a poor understanding of the hypothetical scenario created from which WTP questions are asked. If respondents misunderstand the scenario or the scenario is misrepresented by the interviewer, it will lead to responses that do not match the hypothetical scenario hence biases. This can be minimized by well explaining the hypothetical scenario and avoiding any ambiguity whatsoever. Hypothetical bias may also arise because people may respond differently to hypothetical decisions compared to how they make actual decisions.

Interview and Compliance bias: Interview bias arises from the conduct of interviewers that tend to influence the responses given by the respondents in a survey. Compliance bias arises when respondents attempt to give answers that they think may please the interviewer. These biases can be minimized by training interviewers well to adhere to the principles of conducting an effective survey.

Non response bias: Non response bias results from the fact that some sample members do not respond and yet they have values for the resource which may be different from those given by respondents. This has the tendency to bias the overall value placed on the resource.

Information bias: Information bias arises because respondents may be asked to value attributes for which they have little or no knowledge of. This means that the information that they are given to the respondents will have substantial influence on their responses.

Despite the likelihood of several biases that may arise when the CVM is employed, there are effective means by which to reduce these biases or eliminate them in some cases as have been discussed. This makes it less costly to use the CVM since the potential biases

may be dealt with as opposed to the earlier valuation methods discussed whose biases may be difficult to overcome.

One major merit of the CVM over other valuation methods is its ability to measure both use and non-use values. It is able to measure the total economic value of a resource because respondents will consider both the use values as well as no use values of the resource to them before arriving at the maximum amount they are willing to pay for the resource or willing to accept for deterioration in the resource. CVM is also the most widely used because it is widely applicable as Hanley *et al.* (2002) posited. According to Pearce and Turner (1990), the CVM is the only known technique for finding the value of many non-market benefits especially their non-use values. The ability of CVM to capture non-use values is further confirmed by Li *et al*. (undated). Compared to other methods especially revealed preference methods, the CVM has an advantage. It is flexible enough to allow for the creation of hypothetical market scenario. These hypothetical scenarios may go beyond observed market behaviour and thus helps to measure existence values that are not related to the consumption of other goods. These, among others, are the reasons for which the CVM is the valuation technique or method being employed.

2.5 Willingness to Pay (WTP) and Willingness to Accept (WTA)

To measure the value people are willing and able to pay for safer vegetables, two main methods of measurement are used; willingness to pay and willingness to accept. According to Hecht (1999), the basic aim of attaching monetary values to goods and services is to enhance the understanding of persons' willingness to pay (WTP) and willingness to accept (WTA) those goods and services they now enjoy for free or are losing now.

Willingness to pay shows the maximum amount of money one is willing and able to give up in order to get more of another good. On the other hand, willingness to accept refers to the least amount of money one is willing to receive to get less of another good. It is also known as compensation. Stated preference approach which involves contingent valuation, random utility and choice experiment methods is used for willingness to pay studies.

Hicks (1941) developed two measures of utility change which can be used to study the value attributed to a good or service in a contingent valuation survey – compensating variation and equivalent variation (Table 2.1). Compensating Variation is the change in income that would 'compensate' for a price change. It is the maximum amount that an individual would give up for a good or service to keep his utility constant. Equivalent Variation is the change in income that will be 'equivalent' to a proposed price change. It is the minimum amount an individual would accept to forego a good or service or lose some part of the good

Table 2.1: Hicksian monetary measures for the effects of a price change

Price Change	Compensating Variation	Equivalent Variation
Price fall	Willingness to pay for the change occurring	Willingness to accept compensation for the change not occurring
Price rise	Willingness to accept compensation for the change occurring	Willingness to pay for the change not occurring

Source: Mantey (2013)

Willingness to pay and willingness to accept have the tendency of providing different values for the same commodity change. WTP for a good is usually lower than WTA compensation to forego the same good (Bishop *et al.*, 2001) and many studies have also suggested that people tend to value losses more highly than corresponding gains.

Measuring WTA is often difficult and may be inaccurate with the use of contingent valuation method. Bishop *et al.*, 2001) expanded this by reporting in their studies that WTA compensation in contingent valuation surveys exceed actual WTA compensation for the same goods. On this basis researchers, have almost always focused on WTP in the assessment of the value of a resource.

2.6 Garrett ranking

Garrett and Woolworth (1969) proposed the Garrett ranking method. In this method, a number of factors are presented to respondents to rank in order of their priority. The assigned ranks to the various factors are quantified into percentage positions using the Garrett formula. From the percentage positions obtained, mean scores are computed. The mean scores are then used to tell which factor is more important or predominant. The predominant factor, according to the criterion, is the factor with the highest mean score. As opposed to the Kendall's, the Garrett technique is suitable in a study with a heterogeneous group, heterogeneity could be caused by location, ecology or by climatic conditions. The method has an in-built test of agreement approach, where the mean of scores are found per those who rank the particular factor. Thus, given that all respondents have equal opportunity of identifying and ranking some or all the factors, the final mean score shows the position of the overall sample. Therefore, the Garrett ranking technique

is very useful in making policy recommendations for a diverse population which Ouagadougou; Burkina Faso is not an exception.

2.7 Review of Empirical Studies

2.7.1 Empirical studies on consumers' WTP

In the past years, the demand for niche products by consumers, such as organic or safer foods has grown significantly (Dimitri and Greene, 2002). Consumers value safer foods because they perceive the products to be healthier. This preference could translate into a willingness to pay a premium price for the safer food

Many studies have investigated consumers demand and their willingness to pay for safer products (vegetables and fruits) in both developed and developing countries while, some other studies also focused on consumers' willingness to pay for organic, pesticide-free, fresh and non-genetically modified produce.

Gil *et al.* (2000) employed contingent valuation method to value Spanish consumers' willingness to pay for organic products. Their findings indicated that, consumers were willing to pay higher premium for organic fruits and vegetables. In a study among Canadian consumers, Cranfield and Magnusson (2003) used contingent valuation method (CVM) to examine consumer willingness to pay for pesticide-free food products. Their result showed that, consumers were willing to pay higher premiums relative to a conventional food product.

Boccaletti *et al*. (2000) and Misra *et al*. (1991) also used CVM to analyse consumer willingness to pay for pesticide-free fresh fruits and vegetables in Italy and USA respectively. Moon and Balasubramanian (2001) also used CVM to examine the linkages

between subjective risks and benefit perception and willingness to pay a premium for non-genetically modified (non-GM) food among US and UK consumers. Their findings revealed that, UK consumers were significantly more willing to pay a premium to avoid GM foods than US consumers.

Wang and Sun (2003) on the other hand, used conjoint analysis to examine consumer preference and demand for organic apples and milk in the State of Vermont in the United States. The results suggest that many organic apples and milk consumers, especially people who have purchased organic food products, are willing to pay more for organic food that are produced locally and certified.

Nouhoheflin *et al*. (2004) used hedonic pricing method (that is indirect method of valuation) to assess consumers' perceptions and willingness to pay for organic vegetable in Benin and Ghana. Their results revealed that Ghanaian consumers were willing to pay more than 50% as price premium for chemical free vegetable. The price premium for organic foods over comparable conventional food ranged from 10-100%, but the predominant price premium around the world is 10-50% (Bonti-Ankomah and Yiridoe, 2006).

2.7.2 Mean Amount of Willingness to Pay

According to Shukri and Muhamad (2007), consumers are willing to pay a price premium for environment-friendly products stemming from the growing global environmental consumerism. Subsequently, Mohamed *et al.* (2014) noted that the food industry in Malaysia, however, has been affected by changes in socio-demographic and economic structures. These changes have directly or indirectly influenced the production of food required by the increasing population. Likewise, improvements in the standard of living

have caused a paradigm shift in consumer lifestyles towards one concerned with healthy and safety nutrition, and being environmentally friendly. These changes have caused taste and preferences to change accordingly and the demand for products with good quality attributes is on the rise. Thus, it is a necessity for food producers, distributors, and other players along the supply chain to ensure that food provided meets consumer preferences, and eco-label is one of the avenues to ensure that.

Freshley (2009) revealed that, consumers are only willing to pay a 10% premium where the market price premium for "green" products is much higher. Findings from Chi-Ok Oh *et al., (*2015) in a choice modelling approach show respondents to be willing to pay an average of U.S. $0.41–0.76 more for fruit that embodied practices they considered more natural. Their results indicated that disclosing production practices consumers consider more natural could elicit modest price premiums for fruit growers.

Coulibaly *et al.*,(2011) provided some empirical evidence that at a standard price of $0.25 for an average sized head of cabbage or a pack of tomatoes treated with synthetic pesticides, consumers were willing to pay up to 57% and 50% more for organic cabbage and tomatoes, respectively, above that of the treated cabbage or tomatoes in Ghana. Akgungor *et al.,* (2010) revealed that consumer willingness to pay for products with organic labels and certified products is up to 36%. This is a clear indication that consumers value safer vegetables and are willing to pay more for it.

However, these findings contravene earlier results by Hendrik and Recke (2000) which sought to imply that price variations significantly compromise the quality attributes of vegetables.

Nandi *et al.*,(2016) also provided some field results indicating that about 90% of consumers were willing to pay a premium price ranging between 5% to more than 100% in order to acquire better-quality fruits and vegetables; the price premium, which can be 50%–70% of regular prices, is certainly deterring consumers" (Mukherjee, 2013). The obvious question then, is how much consumers are ready to pay a premium for safer foods. Hence, the need to examine the issues to further ascertain how much consumers are willing to pay for safer vegetables.

2.7.3 Determinants of consumers' willingness to pay

Many studies have examined the effects of these socioeconomic factors on consumers' willingness to pay for safer vegetables. Some of them are discussed below.

Boccaletti and Nardella (2000), employed contingent valuation method to measure Italian consumers willingness to pay for pesticide-free, fresh fruit and vegetables. The findings show that, income and risk concern positively influence consumers' willingness to pay whiles education influences WTP negatively.

Bower *et al.* (2003) conducted an assessment of how dietary habits could affect liking and purchase traits. Their study analysed data using analysis of variance (ANOVA) to compare overall mean values for liking, purchase intent and 'willingness to pay more' for the spreads, and for sub-groups effects on these measures. The independent t-test and cross-tabulation with chi-square were then used to compare subject sub-group differences in demographic measures, nutritional knowledge and health concern, etc. The study found gender, age, health concern and nutritional knowledge as mostly having interactive

effects on purchase intent, with females, older subjects and those with high health concern as having higher willingness to purchase health benefit label

Studies conducted by Nouhoheflin *et al.* (2004) on consumers' perception and willingness to pay for organic vegetables in Accra and Tema, Ghana using hedonic-pricing model revealed that, income, age and occupation are key determinants of consumers' willingness to pay for bio-vegetables. Their results further showed that consumers are aware of health hazards linked to chemical pesticides

Contingent valuation method was also used by Garming and Waibel (2006) to measure farmers' willingness to pay to avoid health risk of pesticides in Nicaragua and they found that, willingness to pay is positively influence by, income, education, risk index and presence of children in the household.

Chen (2007) conducted studies to understand what motives determine the consumer's attitude to organic foods in Taiwan, which in turn influence the subsequent purchase intentions. Moderated regression analysis (MRA) was used to ascertain the personality traits of food neophobia and food involvement separately in the behavioural intentions model. The findings suggest that the food-related personality traits of food neophobia and food involvement exert moderating effects on the relationships between some of the food choice motives and the consumer's attitude to organic foods. However, only food involvement exerts moderating effects on the relationships between the consumer's intentions to purchase organic foods. This resonates with the case in Greece where Menegaki *et al.* (2007) studies on the WTU and WTP for recycled water and products

produced found that both attitudinal factors, such as environmental awareness and economic factors, such as freshwater prices and incomes, are significant determinants.

A study by Koster (2007) on the WTP and determinants of actual food choice revealed that, past behaviour, habit and hedonic pricing are mostly better determinants of actual food choice than psychological attributes such as attitudes and intentions. This however, is from a psychological perspective of the predictors of consumer food choices. Angulo and Gil (2007) buttressed this viewpoint attesting that the consumer socioeconomic characteristics, the level of perceived risk, their purchasing behaviour before the incidents and their confidence on certification strategies will, ultimately, determine the premium they are willing to pay, if any.

Ghorbani and Hamraz (2009) conducted a study on consumers' willingness to pay for organic foods, using CVM .Their findings revealed product appearance and consumers' own knowledge as having positive impact on their willingness to pay for organic foods. Also a survey conducted by Schubert (2008) showed that, 70.5% respondents in the United States believe that it is good for restaurants to protect the environment, and green foods that grow locally are slightly more important than organic foods. This suggests that product appearance is considered as a significant determinant in consumers' willingness to pay decisions.

Akgungor *et al.* (2010) studies on Turkish urban population's willingness to pay for organic food using choice experiment method (CE) identified higher income and educated individuals to be much interested in WTP for organic products more and also

have more knowledge of organic products. Also the study shows that, choice depends on consumers' perception of nutritional value and health risk.

Studies conducted by Coulibaly *et al.* (2011) on the determinants of consumer willingness to pay for organically grown vegetables, using hedonic-pricing model (preferences choice) cited size and colour of tomato fruit as the critical attributes that may positively or negatively affect decisions to choose a product. He further argued that the most likely are awareness of chemical residues and health risks, damage free, reliable availability of products, taste, and income level.

A study by Rezai *et al.* (2013) on willingness to pay for green food products in Peninsular Malaysia using the theory of planned behaviour showed gender, geographical area, income, consumers' preference, motivation, intention, perception, environmental friendliness, and food safety significantly influenced consumers' willingness to pay for green foods.

A study by Mohamed *et al.* (2014) on consumers' willingness to pay for eco-labelled food products using Ordered Logistic model, also concluded that education level, income, age, marital status, household size, attitude, past experience, and knowledge significantly influence the WTP for eco-labelled foods.

Very recent studies by Nandi *et al*. (2016) on consumers' WTP for organic foods, using CVM have demonstrated that factors such as family income, size of the family, gender, and other opinion variables such as chemical residue in conventional foods, trust on retailers, taste, and environmental concerns significantly influence consumers' WTP for organic foods. On the other hand, more than 87% of the consumers indicated that, high

price, lack of availability, narrow range, and irregular supply are the major barriers to buying these products.

Overall, it can be concluded from the review that demographic and socioeconomic factors such as age, sex, household size, number of kids, distance, farming experience as well as income, educational level, awareness, status, occupation, shopping motivation, market type are the major determinants of WTP .

The above discussions also revealed that most of the studies undertaken on WTP in relation to foods have employed the CVM. Again CVM provides estimates of the values of many different alternatives from a single application, it allows for the identification of the trade-offs that individuals make between attributes of a good or service. If one of the attributes is the money that a person would have to pay in order to secure the proposed change, it is possible to measure the marginal values of changes in each attribute.

2.7.4 Socioeconomic Determinants of choice of purchasing outlets/points

Fresh vegetable retailing in many developing countries has largely been limited to on-farm and roadside markets. According to Neven *et al* (2004) and Minten *et al* (2008) however, the last decade has seen the emergence and fast growing of non-traditional outlets for retailing fresh vegetables in some of these countries. These non-traditional outlets include supermarkets and specialty stores.

Also the widespread food safety issues involving deadly pathogens and unclean water, especially in developed countries, have led some classes of developing-country consumers to be more discerning about the sources of food they purchase (Okello and Swinton, 2007).

Again, the increase in awareness among developing-country urban consumers, of the medical health dangers of consuming foods grown using unsafe practices and lastly , the general belief among consumers that, vegetables sold through certain outlets (for example, supermarkets and specialty stores) are produced using safer production practices (Ngigi *et al*, 2011).

Despite the changing nature of fresh vegetable retailing in developing-country urban centers, the traditional outlets; roadside markets and the farm gate purchases, have remained significant points of purchase for many city consumers in developing countries and still serves majority of the urban consumers in developing countries (Tshirley and Ayieko, 2008).

Though there has been rapid expansion of non-traditional fresh vegetable retail outlets, many urban consumers still buy at the traditional markets (roadside and farm gate).This suggests that the preference of a consumer to use a given retail outlet is driven by some factors, which this study sought to identify.

Many researches have made efforts to identify drivers of preferred purchasing outlets of vegetables in all parts of the world at different places. Several socio-demographic and economic factors were explored in determining the main drivers of the choice of preferred outlets/ points. Demographic factors often highlighted included educational status, households' size, sex, age and marital status while economic factors include income, asset and farm size.

A survey by Wolf *et al.,* (2005) on 336 consumers about the demographic profile of farmers' markets, suggested that the average market consumer was female, married, and

had a post-graduate degree. Furthermore, Govindasamy *et al.* (2002) examined consumers' shopping habits and venues for fruits and vegetables in farmers' markets. However, they did little research on consumers' WTP for organic fresh produce in different purchasing venues.

In the above mentioned studies on farmers' markets, purchasing outlet and consumers preference, some of them examined the profile of the primary shopper of farmers' markets (Wolf, 1997, Kezis *et al,* 1998, Wolf *et al*, 2005, Onianwa *et al*. 2006). Kezis *et al*. (1998) and Wolf *et al.'s* (2005) studies were consistent in finding that primary shoppers were more likely to be educated, married women. Moreover, Kezis *et al*. (1998) found that consumers' WTP for vegetables and fruits were likely to increase by 17% more if they came from farmers' markets.

Kyureghian *et al* (2013) studied the effect of access to supermarkets and grocery stores, convenience stores, specialty food stores, full-service restaurants, and limited-service eating places on consumers' purchase of fresh produce, and their findings suggested that there was a significant interaction effect of income and densities of supermarkets and other purchasing outlets in urban areas on consumers' purchase of fruit and vegetables.

Also, a study by Volpe and Lavoie (2005) on consumers' buying preferences revealed that national branding of commodity reduces price by 6 to 7% and private labelled item decreases price by 3 to 8% and that, consumers' willingness to pay for a product is associated with the consumers' perceptions towards the product.

Studies by Thilmany and Bond (2006) on consumers' shopping behaviour and preferences for shopping outlets of commodity, indicated that, 76% of participants

preferred to do their primary shopping at supermarkets, followed by 19% for supercentres and 2% Wal-Mart supercentres. The study further revealed that, Wal-Mart supercentres not only impacted consumers' shopping behaviour and preferences, but they also impacted the commodity price.

2.7.5 Constraints' in accessing safe vegetables by consumers

Many studies have examined challenges in accessing safe foods. Some of them are discussed below.

Studies by Nandi *et al*, (2016) revealed that high price; lack of availability, scarcity of product category, and poor product appearance can be seen as the overall challenges to organic food purchase. The authors also revealed that lack of taste, difficulties in cooking, and lack of information could constrain the purchase of vegetable products coming from organic agriculture.

Reports by Davies, Titterington, and Cochrane (1995) revealed that about 81% of the respondents in their study agreed that price is an important indicator for them in making their vegetable buying decisions. High proportions of the respondents are not willing to pay a premium price for organic products although organic products are healthier and do contribute to their health (Piyasiri & Ariyawardana, 2002).

The reviewed literature above (Nandi *et al.*, 2016; Piyasiri and Ariyawardana, 2002; Govindasamy *et al*, 2001; Dimitri & Richman, 2000; Gil *et al.*, 2000; Davies, Titterington, and Cochrane, 1995 and Byrne, Toensmeyer *et al*,.1991; German, and Muller, 1991) provides inadequate empirical results on the challenges confronting vegetable consumers in their buying behaviour. Again, none of the authors has offered a comprehensive strategy in resolving those challenges identified. This gap in the literature

will be covered by this study as it seeks not only to identify, but rank the challenges and suggest possible solutions that inform policy prescriptions as well as marketing strategies for safer vegetable producers.

2.8 Conceptual frame work

Consumers' Willingness to Pay (WTP) is a way or a measure of the amount of resources individuals are willing and able to give up for a reduction in the probability of encountering a hazard that compromises their health. It could also be defined as the sum of money representing the difference between consumers' surplus before and after adding or improving a food product attribute. Therefore, the value individuals attach to improvements in food safety is theoretically measured by the WTP for the safer foods and can be viewed in the context of a consumer choice problem (Adeyonu, *et al.*, 2016).

In Figure 2.2, consumers' knowledge on safer vegetables or its availability influences their willingness to pay for safer vegetables. Consumers' knowledge is determined by knowing the external factors associated with the vegetable (i.e production method, packing and labeling Supply vegetables). Safer vegetables related attributes such as Agro-chemical free, Nutritious, tasty, produce with clean irrigated water and Healtheir nature of the vegetable influences the WTP. The willingness to pay may also be influence by consumer's socio-demographic characteristics such as Sex, age, household size, Education, occupation this further influence the choice of purchasing points/outlets and the constraints in accessing the safer vegetables and the amount consumers are willing to pay for the safer vegetables. As indicated in figure 2.2, these determinants of willingness to pay for safer vegetables trickle down to influence the overall purchasing behavior of consumers of safer vegetables.

Also From figure 2.2, it is important to indicate that favorable demand for safer vegetables which will be manifested in an upward trajectory of safer vegetable demand on the extent to which these challenges are identified and resolved. Economic theory of utility suggests that consumer's WTP is influenced by their individual tastes and preferences, income, attitudes and perceptions towards particular types of products subject to a budget constraint. Other variables such as occupation and education are identified as pivotal in WTP and as well influence the preferred purchasing Outlet.

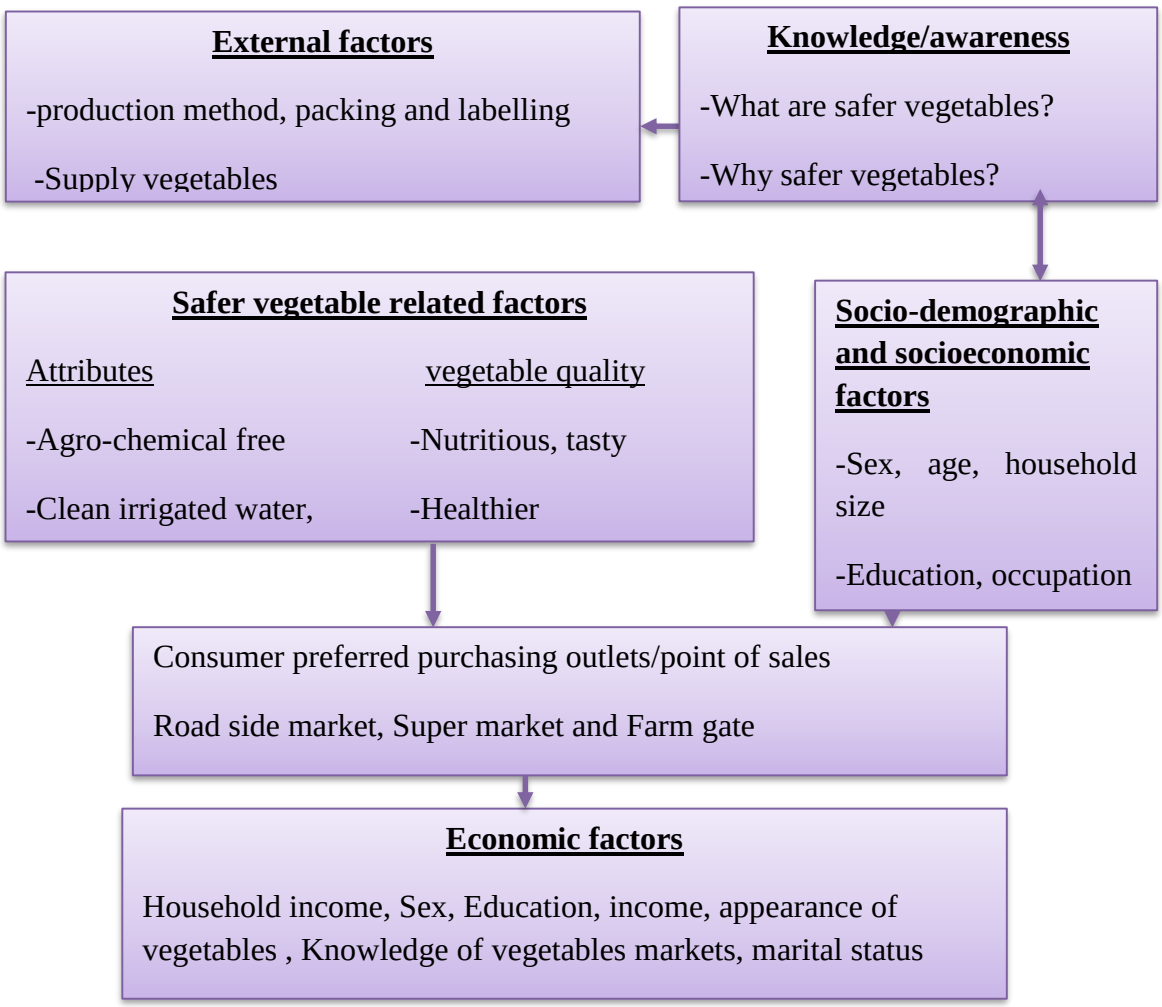

Figure 2.2: Conceptual framework on consumers' WTP and PPO.

Source: Adapted from Ajzen, 1991

2.8.1 Theoretical Framework

Consumers are part of the social and economic groups of people who need safer vegetables. The basic theoretical framework of individual preferences is the standard microeconomic consumer theory of maximising utility, given a budget constraint. The theoretical underpinning of CVM is the theory of consumer behaviour, where a rational consumer aims at maximising utility from any bundle of goods subject to a given budget constraint. CVM was originally proposed by Davis (1963) and is basically used for non-market valuation (Hanley and Spash, 1993). A survey system in which individuals are asked directly to express their WTP/WTA for the hypothetical change being analysed is known as contingent valuation method.

The content of a contingent valuation survey was divided into three parts by Mitchell and Carson 1989 as follows; a detailed description of the good(s) being valued; and the hypothetical circumstances under which it is made available to the respondents; questions which elicit respondents' willingness to pay for the good(s) being valued; questions about respondents' characteristics (e.g., sex, age, income, education), their preferences relevant to the good(s) being valued and their use of the good(s). Since the elicited values in this approach are contingent on particular hypothetical market of the goods (vegetables) described and explained to the respondents, it is termed the contingent valuation (Carson et al. 2010).

2.9 Conclusion

The review of literature on consumers' willingness to pay for safer vegetables has highlighted several points that have informed this present study. Literature has been extensively reviewed on the drivers of (WTP) as well as the drivers of preferred purchasing point/outlets and the potential constraints consumers may confront in accessing safer vegetable. Overall, the literature review has informed the choice of methods of analysis used as well as the key concepts used for the study.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter outlines the methodology of the study in seven (7) areas: the study area, the data collection approach, the data analysis methods and presentation, the specification of theory underpinning the study, empirical specification of models, *a priori* expectations and ranking of constraints.

3.1 The Choice of Burkina Faso as the Study Area

There is growing evidence of urban poverty in and around cities in sub-Saharan Africa in the form of food and nutrition insecurity which Burkina Faso is not an exception. Food insecurity has grown to be a structural problem in Burkina Faso, only to be intensified by malnutrition especially in women and children due to increment in crop diseases, with large amounts of the population suffering from stunted growth and micronutrient deficiencies such as anaemia etc (INSD, 2013). These factors combined with high poverty levels have left Burkina Faso vulnerable to chronic high levels of food insecurity and malnutrition. Although some studies have been done across sub-Saharan Africa on urban WTP and food and nutrition insecurity, little is known about the WTP for safer vegetables in Burkina Faso.

3.2 Background and Location

The study is conducted in Ouagadougou, the capital city of Burkina Faso often shortened as Ouaga, formerly of the Upper Volta French also known as the land of the upright/honest people. Burkina Faso is a landlocked country located in the middle of West Africa's "hump". It is geographically in the Sahel zone, the transition zone between the Sahara Desert in the north and the tropical savanna in the south. The country is bordered by Mali to the north west, by Niger in north east, by Benin to the south east and by Cote d'Ivoire, Ghana and Togo to the south with an area of 274,222 sq. km. Burkina Faso has a population of 18.5 million (INSD, 2013). Spoken languages are French (official), and native languages of the Sudanic family, spoken by about 90% of the Burkinabe population (INSD, 2013).

Ouagadougou is the administrative, communications, cultural and economic center of the country. It is also the country's largest city and has a population of 1,750,250 as of 2010. The inhabitants are called Ouagalais. Geographically, Ouagadougou is situated on the central plateau (12.4° N 1.5° W). The climate of Ouagadougou is hot semi-arid under Köppen-Geiger classification, that is closely borders with tropical wet and dry (Aw). The city is part of the Sudano-Sahelian area, with a rainfall of about 800 mm (31 in) per year. The rainy season stretches from May to October, with a mean average temperature of 28 °C (82 °F). The cold season runs from December to January, with a minimum average temperature of 16 °C (61 °F). The maximum temperature during the hot season, which runs from March to May, can reach 43 °C (109 °F). Ouagadougou's climate is mainly determined by harmattan and the monsoon wind.

The economy of Ouagadougou is based on agriculture with some industrial facilities now relocated from Bobo-Dioulasso to Ouagadougou, which has also made the city an important industrial centre of Burkina Faso. The industrial areas of Kossodo and Gounghin are home to several processing plants and factories. The industry of Ouagadougou is a sector that fuels urban growth, as people move to the city from the countryside to find employment in the industries. The economy is dominated by the informal sector and characterized by petty commodity production, with workers not necessarily having salaries. Traditional, informal trade is widespread and concentrated around markets and major roads, with few outlets in neighbourhoods. There are also instances of modern economic practices with workplaces having qualified, stable labour forces, or more traditional forms of business such as family businesses. The primary industries are food processing and textiles. It is served by an international airport which is linked by a railway to Abidjan in the Ivory Coast. There is also a paved highway to Niamey, Niger, south to Ghana and southwest to Ivory Coast. Ouagadougou has one of the largest markets in West Africa, with other sites of attraction which include the National Museum of Burkina Faso, the Moro-Naba Palace, the National Museum of Music, and several craft markets. The tertiary sector is also an important part of the economy and comprise of communications, banking, transport, bars, restaurants, hotels, as well as administrative jobs.

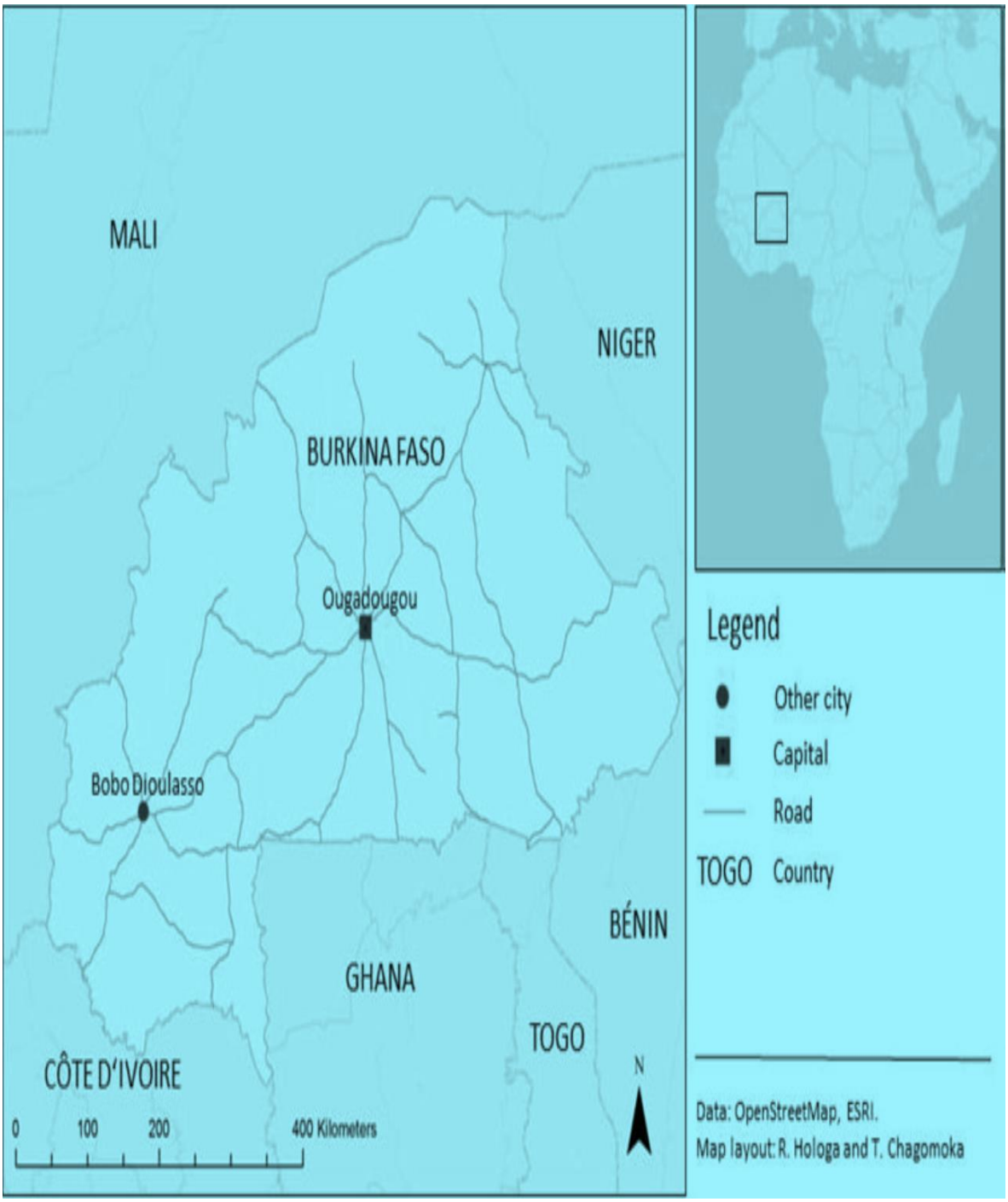

Figure 3.1: A Map of Burkina Faso showing the capital city (Ouagadougou).

Source: Chagomoka et al (2009)

3.3 Research Design

The research design for the study was a cross-sectional survey design. Semi-structured questionnaire were designed to collect a range of data on how much consumers are willing to pay for safer vegetables, determinants of WTP, socioeconomic determinants of preferred purchasing point/outlet and constraints in accessing safer vegetables

3.4 Data type and data collection

Data for the study was primary and constituted both Qualitative and Quantitative data. The data was gathered through a household survey by the use of a semi-structured questionnaire aided by a face- to- face interview of consumers' of tomatoes, cabbage and lettuce..

3.5 Sample size and sampling technique

The target population for the study were consumers of vegetables in Ouagadougou. A sample size of 350 consumers of vegetables was used for the study. The sample size was determined with the formula:

$$n = \frac{t^2 * p(1-p)}{m^2} \qquad [1]$$

Where n = the required sample size, t = the confidence level at 95% (standard value of 1.96), p = estimated population percentage under study (35%) (INSD, 2013) and m^2 = margin of error at 5% (standard value of 0.005). Assuming a margin of error of 5% and a total estimated population percentage of 35% or 0.35% on consumption of vegetables in Ouagadougou, the formula above gave a sample size of 349.6 or 350 respondents which was used for the study.This sample size is considered partly for statistical reasons and

partly for logistical considerations. Statistically, the sample size is large enough to study and make generalizations about the population.

Multi-stage sampling technique was used to identify respondents. At the first stage a random sampling technique was employed to select ten (10) districts in the major tomatoes, cabbage and lettuce growing areas of the capital city, Ouagadougou. The second stage (2) entailed the use of stratified sampling using income level based on housing structure to select one (1) sector in each District. The third (3) stage was the selection of thirty five (35) households from each stratum with the systematic sampling technique. Finally, stage four (4) was the selection of a respondent from each household who is responsible for buying or cooking food or the head of the household. In all a total of three hundred and fifty (350) respondents made up women and men responded to the questionnaires.

3.6 Method of Data Collection

Though there exist vegetables in Ouagadougou which many perceived to be safe, however this study attempted to sell a safer vegetable to them and therefore wished to find out their willingness or otherwise to buy the safer vegetables. In this regard, a product scenario was developed to value food safety. A hypothetical market scenario in which vegetables are produced and sold under attributes such as clean irrigation water, pesticide-free, free from agrochemical usage, hygienic/clean environment of sales and soil testing was constructed for the consumers. Consumers were then asked whether they were willing to pay or otherwise.

Actually a range/series of price premiums was then chosen as a means of payment to obtain the precise amounts consumers were willing to pay. Both the open-ended and the

two-stage process of CV method, also known as the double bounded method was used to elicit consumers' willingness to pay. An Ordered probit model was then used for the estimation. The current market prices were used as the start- up prices, then followed by the first stage, where a respondent (n) is asked if he/she would be willing to pay a certain bid (A) for a good. If he/ she accept, then he or she is offered a second, higher bid *B*; but should he/she reject the initial bid, a second bid is then offered which is a lower bid, C and D. The possible outcomes, are "yes-yes", "yes-no", "no-yes" and "no-no" responses.

Empirically, the values of the ordinal dependent variable "willingness to pay Amount (WTPA)" for an average-sized cabbage of 1.5kg, 1kg of a bundle of lettuce and 1kg of tomatoes were as follows

Cabbage	**Lettuce**	**Tomatoes**
$\left\{\begin{array}{c} \text{WTP} > \text{CFA } 600 \\ \text{CFA } 400 < \text{WTP} < \text{CFA } 600 \\ \text{CF A250} < \text{WTP} < \text{CFA } 400 \\ \text{WTP} = \text{CFA } 250 \\ \text{Not WTP} = 0 \end{array}\right\}$	$\left\{\begin{array}{c} \text{WTP} > \text{CFA } 700 \\ \text{CFA } 400 < \text{WTP} < \text{CFA } 700 \\ \text{CFA } 250 < \text{WTP} < \text{CFA } 400 \\ \text{WTP} = \text{CFA } 200 \\ \text{Not WTP} = 0 \end{array}\right\}$	$\left\{\begin{array}{c} \text{WTP} > \text{CFA } 500 \\ \text{CFA } 300 < \text{WTP} < \text{CFA } 500 \\ \text{CFA } 150 < \text{WTP} < \text{CFA } 300 \\ \text{WTP} = \text{CFA } 200 \\ \text{Not WTP} = 0 \end{array}\right\}$

These choice sets were ranked based on the following:

$$\left\{\begin{array}{c} 4 = \text{Highest willingness to pay bidder} \\ 3 = \text{moderate willingnes to pay bidder} \\ 2 = \text{lowest wiilingness to pay bidder} \\ 1 = \text{not willing to pay a primium price} \\ 0 = \text{not willing to pay at all} \end{array}\right\}$$

3.7 Challenges of contingent valuation (CVM) and means of minimization

The Contingent Valuation Method (CVM) has the following challenges: starting point bias, hypothetical bias, information bias, strategic bias.

Starting point bias: This arises when the starting bid given by the interviewer goes to ultimately influence the final biding response by the respondent. This bias was best minimized by varying the starting bid among the sample so as to enable the interviewer to investigate the influence of the starting bids on the final bid of WTP.

Hypothetical bias: To minimize hypothetical bias in this study, the cheap talk scripts developed by (Cumming and Tayler., 1999) was used. The approach involves informing the respondents sufficiently about the issue of hypothetical bias so that they will self-correct for it. A cheap talk script explicitly stresses the potential problem of hypothetical bias before the respondent answers the WTP questions. Specifically, the cheap talk script describes the problem of hypothetical bias to the respondents and explains why hypothetical bias might occur. A budget constraint reminder is also often mentioned to further mitigate hypothetical bias. The cheap talk script also advises the participants to focus on the actual cost of the hypothetical alternatives and asks the respondents not to overstate their true WTP and focus on their responses assuming a real-life setting (Murphy, Stevens, & Weatherhead, 2005b). Therefore, it is meant to encourage and motivate respondents to reveal their real WTP.

Information bias: Information bias arises because of lack of respondent's knowledge on the product and this influences their response. This was corrected by adequately informing respondance about the product.

Strategic bias: This is a form of bias where respondance deliberately understates their WTP or overstates their WTA. A discrete choice format where 'yes' or 'no' responses was used within the sample to minimize this bias.

3.8 Data presentation and analysis

The study employed quantitative techniques in the analysis, both parametric and non-parametric methods were used in the analysis. Descriptive statistics (i.e the mean, standard deviation and variance of the respondents' scores to all the statements in each of the sections of the questionnaire were computed). To determine the factors influencing consumers' willingness to pay for safer vegetables in Ouagadougou, Burkina Faso, the Ordered Probit model was employed, Multinomial logit was also used in determining how the socioeconomic characteristics of vegetable consumers affect their preference in purchasing /shopping outlet. Finally, the objective to identify and rank the constraints' consumers face in accessing safer vegetables was determined with the Garrett ranking techniqu Garrett *et al.*, (1973).

3.9 Empirical specifications of models

Empirically, in estimating WTP, the utility function and the commodity attributes are essential factors to consider (Franklin *et al*, 2014). From the utility theory, in equation 2 below, a consumer aims at maximising utility derived from consuming a safer vegetable given the quantity of the safer vegetable.

$$U = u^{*}(q_{1,}q_{2}, q_{3} - - - - q_{n}) \qquad [2]$$

Where $U = Utility$, $u^{*} = change - in - utility$, $q_1, q_2, q_3 - - q_n = Quantities$

One's utility function is the taste and preference on a given commodity subject to a budget constraint. Khuc (2013) indicated that an individual utility (U^{*}) maximisation is achieved by seeking to minimize his or her expenditure. Therefore, expenditure function

for the consumer when the quantity (q_0) of safer vegetable is delivered by a seller without charging a fee is given as:

$$e = e(p_{0,} q_0 u^*) \quad [3]$$

Where $e = Expenditure,\ \ p_0 = initial - price, q_0 = initial - quantity, U^* = initial - Utility$

If a consumer is willing to pay for a required quantity and quality of safer vegetable (q_1) to meet his or her own desire in consumption, then the consumer should be prepared to increase his or her expenditure. The WTP is then derived as the difference in the consumers' expenditures, thus:

$$WTP = e(p_{0,} q_{0,} u^*) - e(p_0, q_1, u^*) \quad [4]$$

$$\text{Where } q_1 > q_0 \quad [5]$$

The empirical model is stated as:

$$\text{Mean (WTP)} = \frac{\sum_{i=1}^{n} WTP}{N} \quad [6]$$

The Ordered probit model was employed to determine the factors influencing consumers' willingness to pay for safer vegetables in Ouagadougou, Burkina Faso.

The dependent variable, willingness to pay (WTP), was measured as an indicator variable, and constituted: 4. Consumers who were willing to pay for high price bids "yes-yes", 3.Consumers who were willing to pay for moderate price bids "yes-no" 2.consumers who were willing to pay for lower price bids "no-yes" and 1. Consumers' who were not willing to pay at any discount price "No-no" and 0. Consumers who were not willing to pay at all.

Ordinal values were assigned to each of the choice category with ordinal meaning and shows ranking of the various bids. From Greene, (2004), the ordered probit model is a framework for analysing ordered dependent variables.

The model is built around unobserved latent variable function as:

$$z_i = x'\beta + e \qquad [7]$$

Where

$z_i = Observed, z_i^* = anobserved - latent - \text{var}iables, X = \exp lanatory\ \text{var}iables - and - e_i = Errorterm.$

So that the observed variable z_i is related to the unobserved variable z_i * as:

$$z_i = 0 if z^* \le 0$$

$$z_i = 1 if\ 0 < z^* \le u_i$$

$$z_i = 2 if u_i < z^* \le u_2 \qquad [8]$$

$$z_i = 3 if u_i < z^* \le u_3 :$$

$$:$$

$$z_i = j if u_{j-1} \le z^*$$

Where u_1, u_2, u_3 and u_{l-1} are the unknown parameters representing the thresholds to be estimated with β and z^* measuring the tendency of preference toward the highest category in terms of rank relative to the thresholds, which depends on certain measureable characteristics x and certain unobservable factor e (Greene, 2002; Hill *et al*., 2008). The number of thresholds is one less the number of categories. The intercept

or constant term is not included in the ordered regression because if included, it will result in a perfect collinearity (Hill *et al.*, 2008).

Assume that e_i is normally distributed across observations with mean zero and variance one, then the probabilities for the observed dependent variable y_i is formulated as:

$$prob(WTP_i = 0 \mid x) = \phi(-x\beta)$$

$$prob(WTP_i = 1 \mid x) = \phi(u_1 - x\beta) - \phi(-x\beta)$$

$$prob(WTP_i = 2 \mid x) = \phi(u_2 - x\beta) - \phi(u_1 - x\beta) \qquad [9]$$

$$prob(WTP_i = 3 \mid x) = \phi(u_3 - x\beta) - \phi(u_2 - x\beta)$$

$$\vdots$$

$$\vdots$$

$$prob(WTP_i = j \mid x) = 1 - \phi(u_{j-1} - x\beta)$$

Where ϕ is the probability density function of the standard normal distribution of the error term. The threshold parameters u_1, u_2, u_3 and u_{l-1}, the index function parameter β are estimated by the maximum log-likelihood function using numerical methods (Hill *et al.*, 2008).

For all the probabilities to be positive, we must have the threshold parameters as:

$$0 < u_1 < u_2 <_3 \ldots\ldots\ldots\ldots\ldots\ldots < u_{j-1}$$

Then the marginal effects of x^s are:

$$\frac{\partial prob(Y_i = 0 \mid x)}{\partial x} = \phi(x\beta)\beta$$

$$\frac{\partial prob(Y_i = 1 \mid x)}{\partial x} = [\phi(x\beta) - \phi(u - x\beta)\beta \qquad [10]$$

$$\frac{\partial prob(Y_i = 2 \mid x)}{\partial x} = \phi(u - x\beta)\beta$$

Therefore, the sign of the parameter β is opposite the direction of the marginal effect for the lowest category, but it indicates the direction of the marginal effect for the highest category (Hill *et al.*, 2008).This implies that when β is positive for x, the probability of the lowest category $prob(Y_i = 0 \mid x)$, will decline. In other words, the derivative of $prob(Y_i = 0 \mid x)$ has the opposite sign for β (Greene, 2004). In totality, the signs of changes in the extreme upper and lower categories $prob(Y_i = 0 \mid x)$ and $prob(Y_i = 3 \mid x)$ respectively are unequivocal and unambiguous, but direction of the marginal effects for the middle categories goes one way or the other, depending on the sign of the difference in bracket, rendering the direction ambiguous (Greene, 2002; Hill *et al.*, 2008).

Empirically, the latent variable z_i was assumed to be influenced by factors such as:

$$WTP = \beta_1 Age + \beta_2 Education + \beta_3 Occupation + \beta_4 HHSize + \beta_5 Numberbofchildren + \beta_6 Income + \beta_7 Appearanceofvegetables + \beta_8 Trustingovernment + \beta_9 Financailrisk + \beta_{10} Healthconcern + \beta_{11} Accessto\,\inf\,ormation + e_i \ldots\ldots\ldots\ldots\ldots\ldots [11]$$

Table 3.1: Description of variables and *a priori* expectations of determinants (WTP)

Explanatory variables	**Description of variables**	**Measurement**	**Slope coefficient**	**A*priori***
Age	Age of Respondents'	Year	$\beta 1$	-
Education	Respondents' educational level	1 if educated, 0 otherwise	$\beta 2$	+
Occupation	Respondents' occupation	1 if a salary worker, 0 otherwise	$\beta 3$	+
HH size	Number in a household	Number	$\beta 4$	+/-
Number-of children	Number of children in a household	Number	$\beta 5$	+/-
Income	Consumers' earnings	Amount (CFA)	$\beta 6$	+
Appearance of vegetables	Appearance of vegetables (colour,size texture)	1 if considers appearance 0 otherwise	$\beta 7$	+/-
Trust in government	Consumers trust in government	1 if trust, 0 otherwise	$\beta 8$	+/-
Financial risk	Consumers' willingness to risk their finances	1 if ready to risk, 0 otherwise	$\beta 9$	+/-
Health Concern	Consumers' concern about their health	1 if concern 0 otherwise	$\beta 10$	+
Access to information	Consumers' access to information on vegetables	1 if getting access 0 otherwise	$\beta 11$	+

To determine how consumers' socioeconomic characteristics affect their preference for purchasing point/outlets for safer vegetables in Ouagadougou, Burkina Faso, the Multinomial logit model was used. It was used on the basis that the preferred purchasing outlets are mutually exclusive. Three purchasing points/outlet were predetermined for the studies; 1. Shopping at super markets; 2. Shopping in the open/roadside markets and 3. Shopping at the farm gate. Respondents were then asked to select only one out of the three. A rational consumer of safe vegetables chooses among the different shopping outlets that yield maximum utility. Greene (2003) indicates that the utility obtained can be decomposed into observed and unobserved components expressed as:

$$U_{ij}(X_{ij};Z_{ij}) = V_j(X_{ij};\beta) + \varepsilon \qquad [12]$$

Where: $U_{ij}(X_{ij};Z_{ij})$ denotes the utility of i^{th} individual choosing alternative, $j; V_{ij}(X_{ij,}Z_{ij})$ denotes the deterministic component of the utility.

The deterministic part is modelled using the multinomial logit. Following from (Greene, 2003; Cameron and Trivedi, 2005; Mpuga, 2008; Eneyew, 2012) the conditional probability of the Multinomial logit model was specified as:

$$prob(Y_i = j / X_i)\frac{\exp(x_i\beta_j)}{\sum_{j=0}^{k}\exp(x_i\beta_j)} \qquad [13]$$

Where j=1, 2…k. The base category is used to compare other choices by restricting the parameters of the base category to all zero ($\beta = 0$). The first choice category is consumers who buy safer vegetables from the roadside markets. The estimation of the Multinomial logit is by maximum likelihood method. The log likelihood function is

$$\ln L = \sum_{i=1}^{n}\sum_{j=1}^{k} d_{ij} \log(p_{ij}) \qquad [14]$$

The Multinomial logit model is interpreted in terms of odds. The odds of outcome *m* versus outcome *n* gives *X* depicted by $wm/n(X_i)$ is:

$$wm/n(X_i) = \frac{pro(y_i = m/X_i)}{pro(y_i = n/X_i)} = \frac{\ell(x,\beta_m)}{\ell(x,\beta_n)} \qquad [15]$$

Simplifying equation (15) gives

$$wm/n(X) = \ell(x,\beta_m - x,\beta_n) = \ell[x,(\beta_m - \beta_n)] \qquad [16]$$

Taking the natural logarithm of equation [16] expresses the multinomial logit as linear in the logit:

$$\ln[(wm/n(X_i)] = X_i(\beta_m - \beta_n) \qquad [17]$$

Equation [17] gives the effect of *X* on the logit of outcome *m* against outcome *n*. Also the partial derivatives of the equation [17] gives the marginal effects expressed as:

$$\frac{\partial \ln[wm/n(X_i)]}{\partial X_k} = \frac{\partial X_i(\beta_m - \beta_n)}{\partial X_k} = \beta_{km} - \beta_{kn} \qquad [18]$$

Where $\beta_{km} - \beta_{kn}$ means, for a unit change in x_K the logit of outcome *m* versus outcome n is expected to change by $\beta_{km} - \beta_{kn}$ units.

Empirically, the preferred purchasing outlet was assumed to be influenced by factors such as:

$$PPO = \beta_0 + \beta_1 Sex + \beta_2 marritalstatus + \beta_3 Education + \beta_4 Occupation + \beta_5 HHSize + \beta_6 Income + \beta_7 Appearanceofvegetables + \beta_8 Distancetomartket + \beta_9 Frequencyofpurchase + \beta_{10} Knowledgeofvegetablemarkets \ldots\ldots\ldots\ldots\ldots\ldots [19]$$

Table 3.2: Description of variables and *a priori* expectations on socioeconomic factors influencing consumers' preference for a particular purchasing outlet/point.

Explanatory variables	Description	Measurement	Slope coefficient	*Apriori*
Sex	Sex of the respondent who does the purchasing vegetables	1 if female , 0 if male	$\beta 1$	+/-
Marital status	The marital status of vegetable consumers	1 if married 0 otherwise	$\beta 2$	+
Education	Respondents' level of education	1 if educated 0 otherwise	$\beta 3$	+
Occupation	Type of work	1 if salary earning worker 0 otherwise	$\beta 4$	+/-
Household size	Number in a household	Number	$\beta 5$	+/-
Income	Income level of the respondent	France CFA	$\beta 6$	+
Appearance of vegetables	Appearance of vegetables(colour, texture, size)	1 if considered in buying safer vegetables 0 otherwise	$\beta 7$	+/-
Distance	Distance to safer vegetables market	Meters	$\beta 8$	+/-
Frequency of purchase	Respondents' frequency of purchasing vegetables	1 if daily purchase, 0 otherwise	$\beta 9$	+
Knowledge of vegetables market	Consumers knowledge of the availability of vegetables market	1 has knowledge of availability of vegetables market 0 otherwise	$\beta 10$	+/-

The fourth objective which seeks to determine and rank the constraints consumers' face in accessing safe vegetables in Ouagadougou, Burkina Faso, were identified and ranked with Henry Garrett ranking techniques. From a review of literature, both the Kendall's and Garrett rankings are used in analysing constraints on goods and services provision. However, in this study, the Henry Garrett ranking techniques is used for identifying and ranking the constraints of consumers in accessing safer vegetables (cabbage, lettuce and tomatoes) in Ouagadougou Burkina Faso. This technique of ranking was chosen over the Kendall's because of the heterogeneous nature of the selected districts (Garrett *et al.*, 1973).

The process of operationalizing the ranking procedure started with respondents ranking the identified problems in order from the most pressing to the least pressing. Numerical values were used to give weights to the problems with 1 being the most pressing, 2 the second most pressing, in that order to the i^{th} problem representing the least pressing to the j^{th} respondent, (Garrett and Woolworth, 1969).The orders of ranking by consumers of vegetables representing the assigned ranks were transformed into percentages with the formula:

$$\text{Percentage position} = 100\left(\frac{R_{ij} - 0.5}{N_{ij}}\right) \qquad [20]$$

Where: R_{ij} is the rank given for the i^{th} factor by the j^{th} individual and N_{ij} is the number of factors ranked by the j^{th} individual.

The percentage position of each rank obtained was converted into scores by the Garrett conversion score table. The scores for each constraint were summed up and the average

score was then calculated by summing up the score of each constraint and dividing the summed scores by the total number of individuals who ranked that particular constraint.

The average/mean scores determined the order of the constraints. The constraint with the highest (lowest) mean score was regarded as the most (least) pressing and the constraint with the lowest (highest mean score regarded as the (highest) pressing constraint (Garrett and Woolworth, 1969).The following constraint were ranked: prices of safer vegetables; Lack of availability of safer vegetable; Inadequate information on safer vegetables; Distance to the market; lack of trust in market vendors and cultural barriers.

3.10 Definition of Variables Influencing Consumers' WTP and Preferred Purchasing Outlets and the *a priori* expectations.

Consumers' WTP for safer vegetables and the decision to shop at a particular market is influenced by several factors, most important among these factors are, price of the vegetables, consumers' concern about their health, income level, occupation, household size, age and education. Below is the measurement, explanation and *a priori* expectation of the variables used.

Sex: This variable measures the effect of sex on preferred purchasing outlet. It was measured as a dummy variable as 1 if the consumer is a female and 0 if otherwise. From the belief that females like shopping at the super markets, it was expected that female respondents would prefer shopping at the super market to any other markets, thus a positive relationship was expected for super market shopping and negative for both roadside and farm gate for female respondents in the survey.

Age: It was measured in years and was expected to have indirect influence on WTP for safer vegetables . Respondents' in the youthful age bracket are expected to be willing to pay more for safer vegetables. As stated by Polson and Spencer (1992), younger people are more likely to probe into a new product and try it than the older people. On the other hand the aged who are old and do not want to accept new innovations may not be willing to pay for safer vegetables and therefore expected to influence WTP negatively.

Marital status*:* It was measured as a dummy variable, 1 if married and 0 if otherwise and expected to influence preference for shopping at the super market positively. However, it was expected to influence the preference for shopping at both the roadside market and farm gate market negatively.

Education: Education was measured as a dummy variable for WTP and preferred shopping outlet of safer vegetable, where 1 was assigned if a respondent is educated and 0 otherwise. It was expected that educated consumers would be willing to pay more for the safer vegetables and prefer to shop at the super market than the non-educated. Thus education was expected to positively influence both WTP and preference for shopping at the super market.

Occupation: Respondents in salary -earning occupation was considered as the reference category to the other variables of occupation. It was measured as a dummy variable as 1 if a consumer is in a salary-earning occupation and 0 if otherwise. It was also expected to influence WTP and preference for shopping at the super market positively. Being a consumer in a salary working class enables him/her to have the purchasing power, and also prefer shopping at the super market to shopping at the roadside or farm gate markets.

Household Size: It measures the number of people living in a particular household and was expected to influence WTP and preferred purchasing outlets positively or negatively. In the case of a larger household, they may have more mouths to feed hence may rely on quantity and not quality. On the other hand, larger households may have lager number earning cash income thus rely on quality and not quantity. Similar is the case of smaller households who may have fewer mouths to feed hence looking for quality other than quantity or may have less members earning cash income thus choose quantity over quality. In both cases this has the tendency of influencing WTP and preferred purchasing outlets either positively or negatively.

Number of children: Aside the household size the number of children in a household was expected to influence the WTP for safer vegetables. It was measured in numbers and was expected to influence WTP either positively or negatively. It was expected that, households with many children would buy safer vegetables to keep the children healthy while households with less or no child may not need safer vegetables.

Income: The purchasing power of a consumer is measured by his or her income level hence making income a major variable expected to influence both WTP and preferred shopping outlet positively. The unit of measurement for income was in CFA and was measured as a continuous variable.

Appearance of Vegetable: Most consumers are known to look out for quality or quantity in a product by considering its characteristics (size, colour, texture) before expressing the WTP or choosing a particular shopping outlet. Whether consumers consider the appearance (size, colour, texture) of vegetables before buying was also expected to

influence WTP and choice of preferred market either positively or negatively. It was measured as a dummy variable, as 1 if a consumer considers some characteristics (size, colour, texture) before willing to pay or choosing a particular market and 0 if otherwise.

Trust in government: The variable was operationalized by considering if consumers trust or not trusting in the government could influence their WTP for safer vegetables. It was captured as a dummy variable, 1 if a consumer has trust in government and 0 if otherwise. It was expected to influence WTP for safer vegetables either positively or negatively. Consumers' trust in government was expected to have a positive influence on WTP for safer vegetables while consumers not trusting in government was expected to influence WTP for safer vegetables negatively.

Financial Risk: It was captured as a dummy variable, as 1 if a consumer is willing to risk his or her finances and 0 if otherwise. It was expected to have either a positive or negative relationship with WTP for safer vegetables. A consumer's willing to risk his or her finance by buying the new product (safer vegetables) was expected to have a positive influence on WTP , while a consumer not willing to risk his or her finances by not buying the new product (safer vegetables) was expected to have a negative impact on WTP .

Health Concern: The health of a person is very important for his/her total development. In this regard, including health characteristics in the analysis of WTP for safer vegetables is paramount in determining consumer WTP for it. It was measured as a dummy variable, as 1 if a consumer is concerned about his or her health, 0 if otherwise. It was expected to have a positive relationship with WTP for safer vegetables.

Access to Information on Vegetable markets: It was measured as dummy variable and used in capturing the effect of access to information on WTP for safer vegetables, thus 1 if having access to information on vegetables and 0 if otherwise. A positive relationship with access to information was expected as access to information will enable consumers know where to get the safer vegetables to buy and also knowledge on its nutritional value.

Frequency of purchase: It was measured by the number of times a consumer buys vegetables. Daily purchasing was used as the reference category over the other variables and was measured as a dummy variable where 1 was assigned to daily purchases and 0 if otherwise. It was expected that, the more a consumer purchases vegetables daily the greater the preference for buying at the roadside market over other markets

Distance to the vegetable markets: It was used as a dependent variable influencing consumers' preference for a particular shopping outlet/point of safe vegetables. It was measured as a continuous variable in meters. It was expected that, the closeness of a particular shopping outlet to a consumer should influence his/ her preference for that market positively.

Knowledge of vegetables market: It measures the effect of consumer knowledge of the availability of vegetables market on the preference for particular purchasing outlet. It was measured as a dummy variable; 1 if a consumer has knowledge of the availability of vegetables market and 0 if otherwise. It was expected that, increase in consumers' knowledge of the availability vegetable markets increases the preference for buying both at the super market and the farm gate.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

This chapter presents the results and findings of the study. A detailed description of the demographic and socioeconomic characteristics of consumers of cabbage, lettuce and tomatoes, as well as knowledge and household weekly expenditure on groceries (foodstuffs) in the capital city Ouagadougou is discussed. Further, results on the mean willingness to pay amount, factors influencing consumers' willingness to pay, determinant of preferred purchasing outlet/points on cabbage, lettuce and tomatoes and the discussions of ranked potential constraints are discussed.

4.1 Respondents' Demographic and Socio-economic Characteristics

This section discusses the demographic characteristics of households that consume cabbage, lettuce and tomatoes. The characteristics discussed are sex, age, marital status, household size, education and ethnic distribution of household respondents. The results are jointly presented for cabbage, lettuce and tomatoes in Table 4.1 and 4.2

***Sex of Respondents*:** The survey results show that 96.6 % of the respondents are female while the remaining 3.4% are male. This finding could be attributed to the fact that, females are at the center-stage of decision making regarding food/vegetable purchases, though they make such decisions with their husbands based on household income (Kassali *et al.*, 2010). This finding concurs with the sex distribution in Ouagadougou on purchases of vegetables, where 95.0% are female with the remaining 5.0% being male (INSD, 2013). This means that, vegetable farmers should target women other than men.

Age of Respondents: The mean age of the sampled respondents is 37 years. The minimum and maximum ages are 17 and 78 years respectively. Majority of the respondents (62.0%) are within the age brackets 21-40 years, while the least (6.3%) are respondents above 60 years. This suggests that, most of the respondents are within the economically active population. This has prospect on WTP since the majority who are actively working can have income to buy the new vegetables.

Respondents' Marital Status: From the survey results, majority (83.7 %) of the respondents are married while the remaining 16.3% are unmarried as follows: single respondents (11.7%); and divorced (4.6 %.). this is also expected to have positive influence on WTP and preferred purchasing outlets/point of sales of vegetables, since the married usually cook at their homes compared to the barchallers who usually buy from the canteens or resturance.

Respondents' Household Size: The mean household size of the sampled households is 5 and ranges from 1 to 13 members. This average size is slightly below the cities average of 6.2 members in a household (INSD, 2013). The households with 6-10 members accounts for 41.1% of the sampled households while the remaining households with more than 10 members account for 0.3%.The survey revealed that, majority (58.6%) of the households with membership of 5 and below are into commercial activities and live in the urban centers while households with more than 10 members (0.3%) are into farming activities and mostly live in the villages.

Table 4.1: Socio-demographic Characteristics of Vegetable Consumers in Ouagadougou

Variable	Category/Description	Frequency (n=350) (%)
Sex		
	Female	338 (96.6)
	Male	12 (3.4)
Age		
	Less/equal 20	21 (6.0)
	21 – 40	217 (62.0)
	41 – 60	90 (25.7)
	60+	22 (6.3)
Marital status		
	Married	293 (83.7)
	Single	41 (11.7)
	Divorced	16 (4.6)
HH Size		
	Less/equal 5 people	205 (58.6)
	6-10 people	144 (41.1)
	More than 10 people	1 (0.3)
Educational Level		
	None	79 (22.6)
	Arabic school	11 (3.1)
	Non formal	1 (0.2)
	Primary	107 (30.6)
	Junior High School	69 (19.7)
	S.H.S/Vocational/Technical	58 (16.6)
	Tertiary	25 (7.1)
Ethnic Affiliation		
	Mossi	217 (62.0)
	Peul	25 (7.1)
	Lobi	13 (3.7)
	Bobo	28 (8.0)
	Senufo	8 (2.3)
	Gurunsi	24 (6.7)
	Others	35 (10.0)

Source: Computed from Household Survey Data, 2016.

Note: Values in parenthesis represent percentage

Table 4.2: Households Composition in the Study Area

Variable	Mean	Standard Deviation	Minimum	Maximum
Age	36.67	12.25	17	78
HH Size	5.26	1.79	1	13
Number of children	2.17	1.31	0	7
Educational level	4.00	1.97	1	7

Source: computed from households' survey data, 2016.

Educational Level: The survey results show that 77.4% of the sampled urban consumers of vegetables are illiterate while the remaining 22.6% are literate. Out of literate, majority of the households (30.6%) have had primary education, followed by 19.7% who also went through the Junior High School education. The least is a respondent with non-formal education representing 0.3%. The mean years of education also shows that on average the highest level of education attained by a respondent is primary education (approximately primary 4). This is consistent with the finding of the INSD, (2013) which indicated that, about half of adults in the Ouagadougou neither attended school nor completed middle school/JHS. This has the tendency of bringing in negative influence on the willingness to pay for safer vegetables. Also, according to Minot *et al.* (2006) education is a means of entry into extra employment activities especially in the service sector. With majority of the respondents in the city without formal education, it confirms the survey results which showed that majority of the respondents are into petty trading.

Ethnic Affiliation: From Table 4.1, the largest ethnic group in the sample (62.0%) is Mossi. This large representation is expected since the Mossi's predominantly occupy the capital city of the country. Bobo are the second largest group in the sample (8.0%) who are also predominantly found in Pisi, and Bolmengu sectors of the city. Peul represent 7.1% of the sample, while the least represented is Senufo 2.3% who are traditionally from the Bobo sector.

4.2. Socio-economic Characteristics of Respondents

This section discusses the socio-economic characteristics of the sampled households' respondents**.** The economic and sociological position of an individual or a household is measured by the socio-economic characteristics. Therefore, it is vital to evaluate the household income and occupation of consumers of vegetables when assessing household socio-economic status which could aid in establishing their willingness to pay for the new vegetables (safer vegetables). The results are presented in Table 4.3.

Main Economic Occupation: The results from Table 4.3. show that most of the respondents (44.9%) are engaged in petty trading; this is followed by salary workers (14.9%) and the least being farming (0.9%).Lack of formal education of the sample respondents probably accounts for the majority being women and also engaged in petty trading.

Table 4.3: Socio-economic Characteristics of Vegetable Consumers

Variable	Category/Description	Frequency	
Main Economic Occupations		*(N=350) (%)*	
	Own farm	3.00	(0.9)
	Daily wage labour	33.0	(9.4)
	Salaried worker	52.0	(14.7)
	Petty trader	157	(44.9)
	Craftsman	47.0	(13.4)
	student	44.0	(12.6)
	none	7.00	(2.0)
Monthly Earnings/ Income of respondents	**CFA (GH¢)**		
	Less /equal CFA 50,000 (GH¢350)	49.0	(16.4)
	CFA50001-150,000 (GH¢350-1050)	86.0	(28.8)
	CFA150001-250,000 (GH¢1050-1750)	52.0	(17.4)
	Above CFA 250,000(>GH¢1750)	39.0	(13.0)

Source: Computed from Household Survey Data, 2016.

Household Earnings/Income**:** The results show that the mean monthly households' income is CFA 47002.00 (GH¢329.00) and ranges between CFA3, 000.00 (GH¢ 21.00) and CFA300, 000.00(GH¢2100.00). Majority of the households (72.9%) earn income between CFA3, 000.00 (21.00) and CFA50, 000.00(GH¢350, with fewer households (1.1%) earning above CFA250, 000.00(GH¢ 1750.00). The survey also revealed that households' income basically comes from petty trading and salary earnings. The average income could be said to be relatively high and this could be a prospect for willingness to pay for the safer vegetables. However, the survey results revealed that, a smaller proportion of the income is spent on consumable while more of the income is spent on capital goods such as land, building and human capital (education). This means that, increased in household size may likely have negative impact on WTP.

4.3. Household Weekly Expenditure on foodstuffs

Table 4.4 provides details of the number of respondents who consume each food item, the average frequency of shopping, average amount per shopping and average amount spent per week.

Table 4.4: Average Food Shopping Frequency and Amount per Week

Food Item	Number of Consumers who Consume Food Item (n = 350)	Average Frequency of Shopping	Average Amount per Shopping (CFA)	Average Amount Spent per Week (CFA)
Rice and rice products	348	3.65	17571.07	6293.49
Meat/Fish	322	1.25	1024.14	3982.97
Fruits	161	2.48	467.86	639.80
Beverages(non-alcoholic or alcoholic)	293	1.38	686.00	461.92
vegetables	350	21.12	1101.30	5662.89

***Source*:** Author's Estimations from Field Survey, 2016.

Almost all the sampled households (99.0%) consume rice and rice products, while 83.7% consume beverages, non-alcoholic or alcoholic. Also 46.6% consume fruits. Other food items consumed by the households are "Acheke", plantain, groundnut paste and "dawadawa".While all the respondents (100%) consume tomato and lettuce, 94.0% consume cabbage. The average weekly household expenditure on vegetables is CFA 5,662.89. The results further indicate that, expenditure on meat/fish had the next largest percentage share of 92.0%, on food consumption expenditure.

4.4 Factors Influencing Vegetable Consumers' Purchasing Decisions

The features of vegetables which include the size, colour and texture, nutritional value, source of irrigation water used for cultivation of vegetables and whether or not agro-

chemicals was used for production were some of the factors hypothesized to influence consumers' purchasing decisions either positively or negatively. The extents to which they influence vegetable consumption are discussed below.

***Appearance of vegetables*:** From the result in Figure 4.1 below, almost all the respondents (98.6%) indicated that, the appearance of vegetables positively influenced their purchasing decisions, always. This confirms the studies by (Prameela *et al.*, 2007), who reported that, product features such as colour, texture, size and taste determine consumer choice. On the contrary, a small proportion (1.4%) of the consumers said that appearance do not influence their purchasing decision.

Nutritional value of vegetables: The Results also revealed that 56.9% of the sampled respondents consider the nutritional value of vegetables in their buying decision always.

However, 30.6% said they did not know the nutritional value of many vegetables hence did not consider that in their buying decision. The remaining 12.6% of the sampled household confirmed not considering the nutritional value when buying vegetables. This finding is consistent with that of Weatherell *et al.* (2003) who stated that many British consumers consider the nutritional value of vegetables before buying due to their health concerns. Similar finding were also drawn by Jones (2002) and Roininen *et al.* (2006).

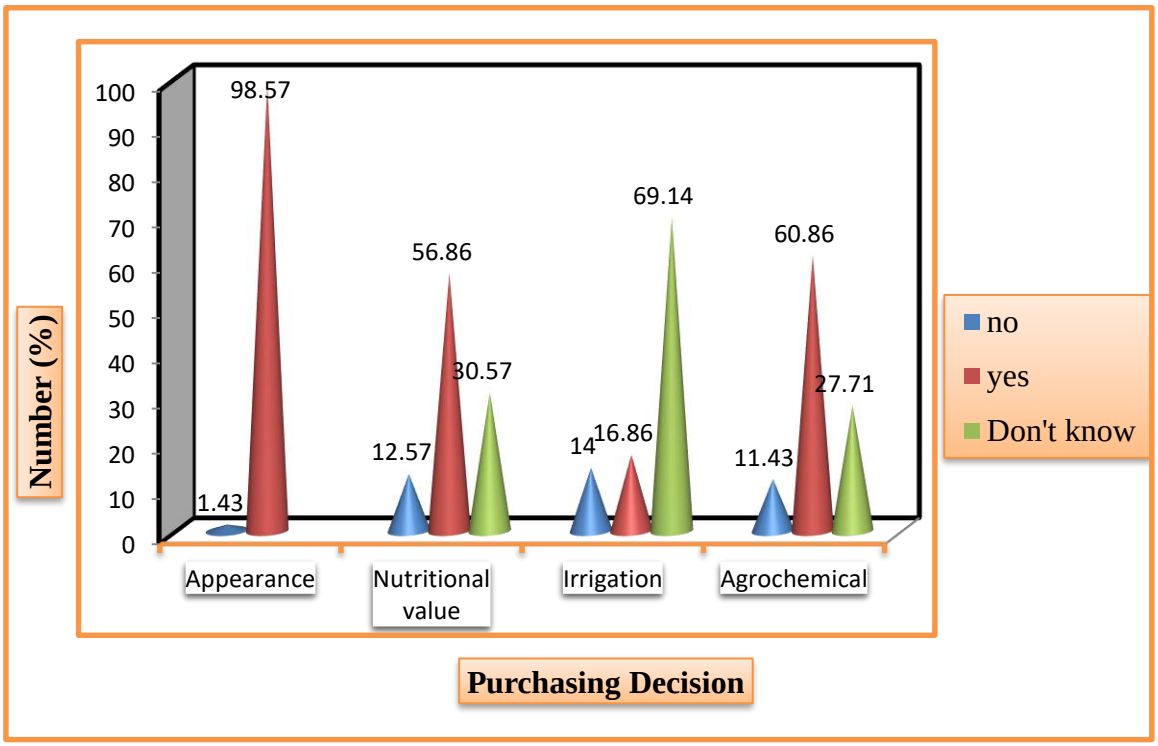

Figure 4.1: Factors Influencing Consumers' Purchasing Decisions

Source: Computed from Household Survey Data, 2016.

Agro-chemicals usage: From Figure 4.1, 60.9% of the sampled population indicated that they considered whether or not vegetable is chemical-free before buying. Other respondents (27.7%) indicated they did not know if a vegetable is produced with or without chemicals. The remaining 11.4% indicated that though they are able to differentiate between chemical free and chemically produced vegetables, they did not consider that in their buying decision.

Source of Irrigational water used: The study results also revealed that, 16.9% of the sampled households said they considered the source of irrigation water used in cultivating vegetables when buying vegetables always. Other households (69.1%) said they did not know the source of irrigation water while the remaining 14.0% said though they knew the

source of irrigation water used in the cultivation of vegetables, they did not consider that in their buying decision .

4.5 Knowledge of the availability of safe vegetable markets

In finding out respondents' knowledge about the availability of safe vegetable markets, three major purchasing outlet/points: super market, Farm gate and the roadside market were explored. Respondents were then asked of their knowledge of the availability of safe vegetables at these markets. From the findings, 85.4% and 81.8% of the respondents said they did not know about safe vegetables in super markets or farm gate respectively while 92.14% respondents said they had knowledge of the availability of vegetables at the road markets and ever purchased it. (See in figure 4.2). This result suggest that, majority of the respondent are likely to prefer buying vegetables at the roadside market over the other market and thus expecting respondents knowledge on vegetable market to have positive influence on consumer preference for buying safer vegetables at the roadside.

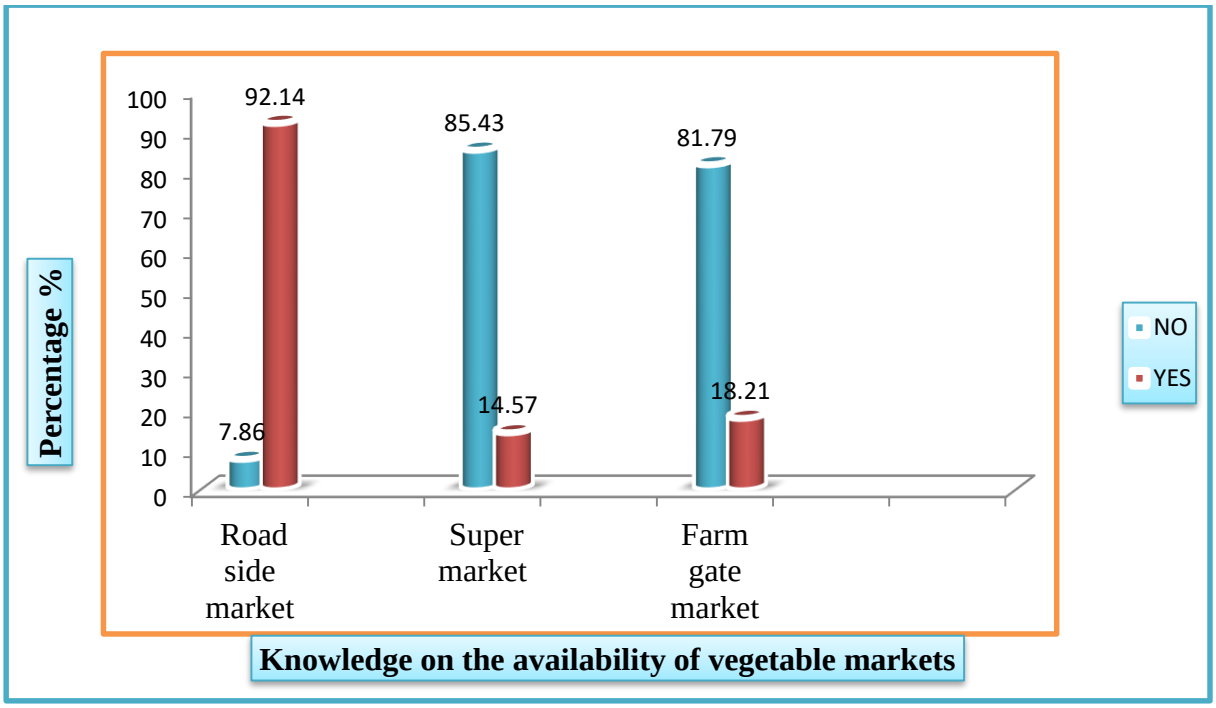

Figure 4.2: Knowledge on the availability of vegetables markets

Source: Computed from Household Survey Data, 2016.

4.6 Consumers' Willingness to pay for safer vegetables

The main objective of the study was to determine if consumers were willing to pay for safer vegetables and if yes, how much they were willing to pay. Even though there exist vegetables in Ouagadougou which many perceived to be safe, in this study, we created a hypothetical market where safer vegetable than the prevailing ones were being sold. The vegetables were cabbage, lettuce and tomatoes. They were safer because of the following: they were produced with clean irrigation water, pesticides-free, free from agrochemical usage and the soil was tested. Consumers were then asked whether or not they were willing to pay higher prices for these safer vegetables. Respondents who were willing to pay more for safer vegetables were further provided with the current market prices of the three selected vegetables from the markets of the sampled districts as the start-up price.

An average sized cabbage of 1.5kg was priced CFA 250(GH¢1.8) 1kg of a bundle of lettuce cost CFA 200(GH ¢1.4) while 1kg of tomatoes cost CFA 200(GH¢1.4). Certain predetermined percentages (125%, 150%, 175% and 200%) based on literature were topped-up and then used for further elicitation of consumers' WTP. From Figure 4.3 below, it is revealed that, a number of households (98.57%) said they were willing to pay more for safer vegetables when made available in the three purchasing outlets/points. Meanwhile 1.43% indicated that, they think the vegetables being sold to them in all the markets are safe hence they were not willing to pay for the proposed safer ones.

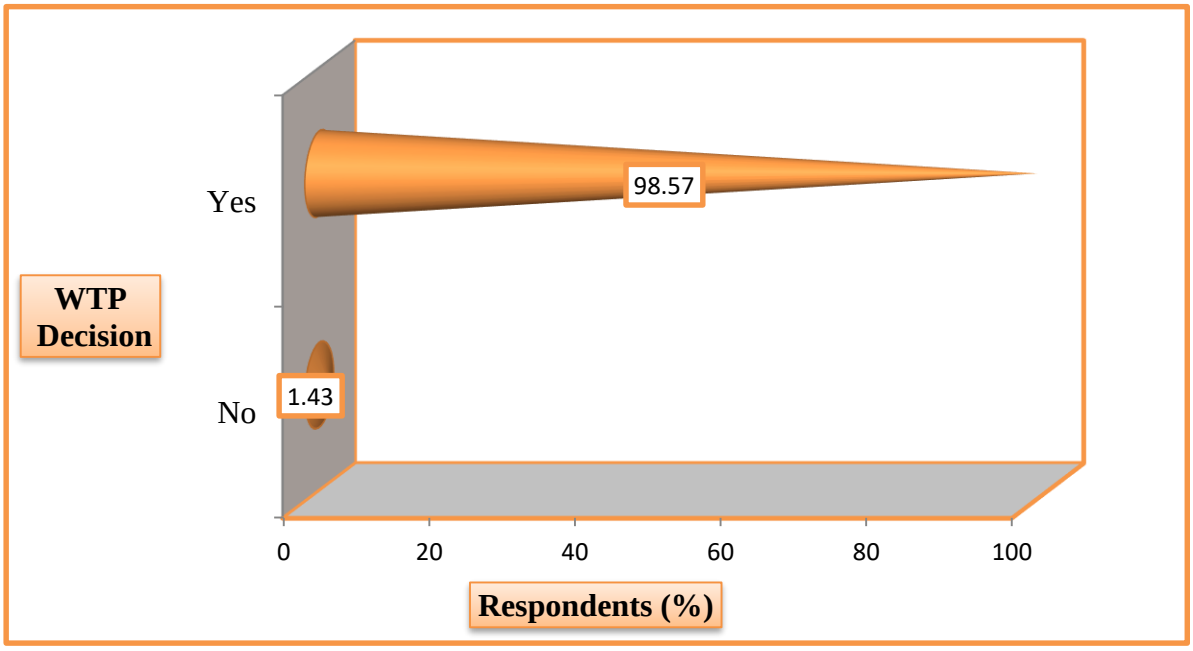

Figure 4.3: Consumers' Willingness to pay for safer vegetables

Source: Computed from Household Survey Data, 2016.

Reasons given by those who were unwilling to pay were as follows: they cannot afford safer vegetables; they think the conventional vegetables being sold to them were safe; the proposed safer vegetables may be found in the city only, therefore the distance to the city

would be a hindrance to them and that aside, their culture does not allow them to buy vegetables in super markets. On the contrary, those who said they were willing to pay more for safer vegetables gave the following reasons: 94.5% stated they can afford safer vegetables; 59.1% said safer vegetables may be more nutritional than the conventional ones; 44.4% also stated safer vegetables may be tastier than the conventional ones; and 91.9% also said safer vegetables may be healthier than the conventional ones. (See Table 4.5)

Table 4.5: Reasons for willingness to pay for safer vegetables

Reason	Frequency (N=350)	Percentage (%)
Can afford the price		
• No	19	5.0
• Yes	326	95.0
More nutritional		
• No	141	40.9
• Yes	204	59.1
Tastier		
• No	192	55.7
• Yes	153	44.4
Healthier		
• No	28.	8.1
• Yes	317	91.9

***Source*:** Computed from Household Survey Data, 2016.

4.7 Frequency/percentages of elicitations on (WTP) for the three vegetables.

Cabbage: Results from Table 4.6 below, shows the frequency and the various percentages on the possible outcomes of the bidding, "yes- yes", "yes-no", "no-yes" and "no-no", for the three vegetables. From the sample on the willingness to pay for safer vegetables, 37.7% responded "yes" to both the first and the second bids, followed by

28.0% respondents' who responded yes to the first bid and "no" to the second bid with the least response "no" "no" representing 8.6%. This implies a larger number of the sampled urban consumers of vegetables are willing to pay more (higher price) for safer cabbage.

Table 4.6: Frequency/percentages to the various elicitations

	Frequency(percentages)			
Types of vegetables	**Yes-yes**	**Yes-no**	**No-yes**	**No-no**
cabbage	132(37.7)	98(28.0)	90(25.7)	30 (8.6)
Lettuce	238(68.0)	55(15.7)	40(11.4)	17 (4.9)
Tomatoes	229(65.4)	61(17.4)	51(14.6)	9 (2.6)

Source: Computed from Household Survey Data, 2016.

Lettuce: Lettuce is one of the major vegetables cultivated and consumed in the capital city of Burkina Faso, Ouagadougou (INSD, 2013). The study revealed that, (68.0%) of the sampled urban consumers are willing to pay very high prices for lettuce, thus they responded "yes- yes" for both bids. Also, 55.0% responded "yes" to the first bid and "no" to the second bid. However, a few (4.9%) responded "no" to both bids.

Tomatoes: Tomatoes is next to lettuce on households' response to" yes-yes" for both the first and second bid representing 65.4%. This is followed by 17.4% respondents who responded "yes" to the first bid and "no" to the second bid. The least on the response for willingness to pay for tomatoes bids were those who responded "no-no" representing 2.6%.This implies a greater number of the sampled urban consumers of vegetables are willing to pay more for tomatoes.

4.8 Mean Willingness to Pay (MWTP) amount for safer vegetables in Ouagadougou

Objective one was aimed at determining how much (mean amount) consumers were willing to pay for safer vegetables. The study revealed that, an average sized cabbage of 1.5kg is currently being sold at CFA 250(GH¢1.8) from the various selected districts in Ouagadougou. If it is now made safer and not harmful to consumers' health, consumers were willing to pay a mean amount of CFA 322(GH¢2.3) which is about 63.5% increment in the current market price. Similarly, on the average, consumers were willing to pay CFA 400(GH¢2.8) for 1kg of a bundle of safer lettuce which is currently being sold at CFA 200(GH¢1.4) on average from the markets of the selected districts, signifying up to about 100% increase in the current average market price. Finally, the average amount the sampled consumers of vegetables in Ouagadougou were willing to pay for 1kg of tomatoes currently being sold on average for CFA 200(GH¢1.4) if safer is CFA 265(GH¢1.9) representing about 59.0% rise in current market price. (See in table 4.7 the detailed statistics on the mean willingness to pay amount for safer vegetables

Table 4.7: Mean Willingness to pay amount (MWTP) for safer vegetables

Safer vegetables	MWTP CFA(GH¢)	Current market prices CFA(GH¢)	Minimum Bid CFA(GH¢)	Maximum Bid CFA(GH¢)
cabbage	322.00(2.3)	250.00(1.8)	225.00(1.6)	600.00(4.2)
lettuce	400.00(2.8)	200.00(1.4)	220.00(1.5)	700.00(4.9)
tomatoes	265.00(1.9)	200.00(1.4)	150.00(1.1)	440.00(3.1)

Source: Compiled from Household Survey Data, 2016.

Notes: *The current market prices represent the average market price obtained from the ten (10) markets of the selected districts in Ouagadougou, Burkina Faso.*

4.9: Summary Statistics of Variables Influencing Consumers' WTP

Several factors come into play regarding consumers' decision to select a particular vegetable among the two competing products**:** safer and safe vegetables in this case. Most importantly, household size, age, Occupation, level of education, price of the product, consumer concern about health, income level and trust in government are key influencers of consumer choice for safer vegetables. Some also depend on consumer level of knowledge, appearance of vegetables and access to information on vegetables market as depicted in Table 4.8.

Table 4.8: Summary Statistics of Explanatory Variables.

Variable	Description	Obs. (n=350)	Mean	Std. Dev.	Min.	Max.
Age	Age of respondents	350	36.670	12.250	17	78
Education	Respondents' highest level of education (in years)	350	4.000	1.970	1	7
Occupation	Respondents' Occupation	350	0.020	0.497	0	1
HH size	Household size	350	5.260	1.790	1	13
Number of children	Number of children in a household	350	2.170	1.310	0	7
Income	Income of respondents' CFA	350	0.946	0.227	0	1
Appearance of veg	Appearance of vegetables (size, colour, texture)	350	0.986	0.119	0	1
Trust in Government	Respondents' trust in government	350	4.346	0.971	0	1
Financial Risk	Financial expenditure risk of respondents' on vegetables	350	2.360	0.854	0	1
Health Concern	Respondents' concern about the health	350	1.400	0.786	0	1
Access to Information	Respondents' access to information on vegetable markets	350	2.457	1.186	0	1

Source: Author's Estimations from Field Survey, 2016.

4.10: Determinants of Consumers' WTP for Safer Vegetables

The second objective of the study was to identify factors that may influence consumers' WTP to pay more for safer vegetables in Ouagadougou, Burkina Faso. These factors were explained separately for the three vegetables namely; cabbage, lettuce and tomatoes as reported in Table 4.9, 4.10 and 4.11. Out of the eleven (11) explanatory variables hypothesised to influence consumers' WTP for safer vegetables, nine (9) were statistically significant in the case of cabbage, five (5) for lettuce and three (3) for tomatoes as discussed below. From the Ordered Probit regression estimates, the Prob > chi2 is *0.0000*, which means that, at least one of the explanatory variables is a significant determinant of WTP for safer vegetables. Also with relatively Pseudo R^2 of 0.1802 for cabbage, 0.1601 for lettuce, 0.1634 for tomatoes and Log-pseudo likelihood of -425.79,-321.49 and -292.00 for the three vegetable being statistically significant, the model is said to be good assuming all the Gauss-Markov assumptions binding.

Table 4.9: Estimated Coefficients and marginal effects of Determinants of WTP for safer cabbage.

Variables	SAFER CABBAGE					
	Coefficient	**No WTP**	**WTP Bid 1**	**WTP Bid 2**	**WTP Bid 3**	**WTP Bid 4**
Age	-0.3131**	0.0070	0.0340**	0.0749**	-0.0031	-0.1129***
Education	0.3589***	-0.0086	-0.0402**	-0.0852***	0.0058	0.1281***
Occupation	0.9729**	-0.0066	-0.0480***	-0.1983***	-0.1186	0.3716**
HH size	0.0658*	-0.0012	-0.0064	-0.0161	-0.0008	0.0245*
Number of children(H)	-0.1220	0.0022	0.0119	0.0298	0.0016	-0.0456
Income	0.6677***	-0.0262	-0.0935**	-0.1388***	0.0469	0.2117***
Appearance of veg	-0.8481*	0.0063	0.0452***	0.1799**	0.0968	-0.3281*
Trust in Government	0.9282	-0.0017	-0.0091	-0.0227	-0.0012	0.03465
Financial Risk	0.2933***	-0.0054	-0.0287***	-0.0716***	-0.0038	0.1095***
Health Concern	0.1739**	-0.0032	-0.0170**	-0.0425**	-0.0022	0.0649**
Access to Information	-0.1022**	0.0019	0.0099**	0.0249**	0.0013	-0.0381**

Model Fitness		**Defined boundaries for 1.5kg of safer cabbage WTP bids**
		No WTP=0
Number of observations	350	Bid 1 = WTP < CFA 250
LR chi2(11)	74.24	Bid 2 = CFA 250 < WTP < CFA 400
Prob > chi2	0.000	Bid 3 = CFA400 < WTP < CFA 600
Pseudo R2	0.1802	Bid 4 = WTP > CFA 600
Log pseudo likelihood	-425.79	

= significant at 10%, ** = significant at 5% and *** = significant at 1%.

Source: Author's Estimations from Field Survey, 2016

Age: From the results in table 4.9, age had indirect effect on WTP for safer cabbage and was statistically significant at 5%. This suggests that respondents' WTP for safer cabbage decreases with an increase in age. This meets the *a priori* expectation and also confirms empirical findings. Similarly, the results for the marginal effects of safer cabbage

revealed that, age of respondents has a U-shape relationship with WTP. The pattern of change from the table indicates that increase in a respondents' age by one year increases the probability of WTP for Bid1 and Bid2 of safer cabbage by 0.03 and 0.08 respectively but decreases for Bid4 by 0.11 at various significant levels. This suggests that WTP for the highest bid of safer cabbage decreases with an increase in a consumers' age, thus older people are willing to pay for lower bids while younger people are willing to pay for higher bids. An explanation to this could be that, the youth are normally not only richer, they are more concerned about their health and adventurous and explorative, are more prone to accepting the new vegetables (safer vegetables). This confirms the study of Polson and Spencer, (1992) who stated that, younger people are more likely to probe into a new product and try it than the older people.

Education: This variable was found to positively influence WTP for safer cabbage and was statistically significant at 1%. This implies that when a consumer is educated, he or she is willing to pay for safer cabbage. Also, the marginal effects showed that for an educated consumer, the probability of willing to pay is 0.04 and 0.09 lower for Bid1 and Bid2 respectively compared to the uneducated, while that of Bid4 is 0.13 higher for educated consumers, holding all other factors constant. This suggests that being a literate directly affects WTP for higher bids of safer cabbage and inversely affects WTP for lower bids of safer cabbage. An explanation to this could be that, educated consumers have greater purchasing power and are also more conscious about their health than the non-educated (illiterates). This finding concurs with the earlier works of Sumukwo *et al.* (2012); Liu *et al*. (2009), but contradicts the findings of Boccaletti and Nardella (2000).

Occupation: Respondents who were into salary-earning occupations were used as reference category against other types of occupations. It was dummied as 1 if a respondent is into a salary-earning occupation and 0 if otherwise. From the results, the variable is positive and significant at 5% level. Thus, salary earners have a higher WTP for safer cabbage than non-salary earners. The marginal effects show that at lower bids the latter are willing to pay for safer vegetables but at the highest bid(4) the former have a 0.37 probability higher to pay for safer cabbage. The possible reason is that higher prices of safer vegetables require availability of money and those in salary-earning jobs have regular income to purchase safer vegetables. Also, respondents in salary-earning occupation are more likely to have higher education, hence know the nutritional value of safer cabbage to their health compared with people in the other working class.

Household Size: Household size is statistically significant at 10% and positively influences willingness to pay for safer cabbage. Also, the marginal effect of Bid4 shows that, holding all other determinants constant, an increase in household size by a member increases the probability of WTP for safer cabbage by 0.03. This variable was expected to have a negative marginal effect because larger household size means that the household may not be able to buy safer vegetables which are more expensive than the conventional ones. Larger households normally have many mouths to feed and so under normal circumstances they would like to make do with the conventional ones which are relatively cheaper. This confirms the *apriori* expectation and also concurs with the earlier finding of Acquah (2011) and Quagraini (2006) in Ghana on WTP for organic and inorganic food.

Income of Respondents: Respondents' income was observed to have a direct effect on WTP for safer cabbage and was also significant at 1%. This suggests that an increase in income of respondents leads to increases in WTP for safer cabbage. Also it is revealed from the marginal effect estimates that, holding all other covariates constant, increase in respondents' income by one CFA decreases the probability of willingness to pay for Bid1 and Bid3 of safer cabbage by 0.09 and 0.14 respectively. However, increase in income to an increase in WTP for Bid4 by 0.21. A possible explanation is that, bid4 represents the highest price and it is with high income that consumers would be able to purchase the safe vegetable. This is consistent with the *a priori* expectation.

Appearance of Vegetable: This variable was found to be statistically significant at 10% but had a negative effect on WTP for safer cabbage, though expected to have a positive effect.The negative coefficient suggests that an enhancement in the appearance of a vegetable decreases with WTP for safer cabbage. The marginal effect revealed that, when the appearance of safer cabbage (size, colour, texture) is better the probability of willingness to pay for Bid1 and Bid2 increases by 0.05 and 0.18 respectively, but at Bid4, the probability decreases by 0.33, other things being equal. The results suggests that, an improvement in appearance of vegetables (size, colour, texture) directly influences WTP for the lower bids and inversely influence the WTP for upper bid (4^{th}) of safer cabbage. Thus, generally, at relatively high price WTP increases with appearance but when the price is too high WTP falls.

Financial Risk: Unlike other variables, financial risk was observed to influence only WTP for safer cabbage. It had a positive influence and was statistically significant at 1%. This implies that respondents who are risk loving are WTP more for safer cabbage than

respondents who are risk averse. The result of the marginal effects show that, for respondents' who are risk loving the probability of willingness to pay for Bid1 and Bid2 of safer cabbage is lower by 0.03 and 0.07 but higher by 0.11 for Bid4.

Health Concern: This variable was found to positively influence WTP and at a significant level of 5% for safer cabbage. Thus, the more a respondents is concerned about his or her health the greater the willingness to pay for safer cabbage. Similarly, the marginal effect for health concern showed that, those who are not concerned so much about their health had 0.02 and 0.04 higher probabilities WTP lower than those who were concerned about their health. However, at a very high price Bid4, those who were concerned about their health had 0.07 higher probability of paying more than those who were not too concerned about their health.

Access to Information: Access to information was observed to negatively influence WTP for safer cabbage at a significant level of 5%, though it was expected to have a positive effect. The negative effect of access to information implies consumers' WTP is lower for consumers with access to information than their counterparts without access to information. Also, the marginal effect showed that, consumers' access to information on safer food have higher probability of being willing to pay for Bid1 and Bid2 of safer cabbage by 0.01 and 0.03 but less probability of willing to pay for Bid4 by 0.04. A possible reason to this could be due to higher price of the 4th Bid of the safer cabbage. This finding concurs with that of Ngigi *et,al* (2011) which indicated that access to information positively influence WTP for quality leafy vegetables at lower bids and negatively influence it at higher bids.

4.11: Determinants of Consumers' WTP for Safer lettuce

Age: From the results in table 4.10, the coefficient of age had an indirect effect on WTP and was statistically significant at 5%. Also the marginal effects results for safer lettuce show that an increase in consumers' age by one year increases the probability of being willing to pay for the lower bids of cabbage by 0.02, 0.05 and 0.04 but decreases for the final bid by 0.12.This suggests that WTP for higher bid of lettuce decreases with an increase in age of a consumer.

Occupation: Unlike safer cabbage, the coefficient of occupation was observed not to have influence on willingness to pay for safer lettuce, while the marginal effects proved to have influence on WTP. It is revealed from the marginal analysis that, for Bids 1 and 2 consumers who were not into salaried employment had a 0.02 and 0.08 higher probabilities of paying more for safer lettuce than their counterparts who were in salaried employments. However, at the highest price, Bid4, the latter had a greater probability of paying more (0.2) than the former.

Household size: For safer lettuce, household size was also observed to have a direct effect on WTP and was statistically significant at 10%, suggesting consumers' WTP for safer lettuce increases with an increase in household size. In addition the marginal effects analysis results for safer lettuce show that increase in household size by a member decreases the probability of WTP for the Bid1, Bid2 and Bid3 of safer lettuce by 0.04, 0.01 and 0.01 respectively, but increases for Bid4 by 0.03 This confirms the *a priori* expectation and that of earlier findings of Acquah (2011) and Quagrainie (2006) in Ghana on WTP for organic and inorganic food.

Income of Respondents: Compared to safer cabbage, the coefficient on respondents' income on safer lettuce was also observed to influence WTP positively and at the same significant level of 1%. The marginal effects estimates of safer lettuce show that, increase in respondents' income by one CFA decreases the probability of willingness to pay for Bid1, Bid2 and Bid3 of safer lettuce by 0.06, 0.12 and 0.06 respectively at various significant levels but increases WTP for Bid4 of safer lettuce by 0.28. This is also consistent with the *a priori* expectation.

Health Concern: Just as the case of safer cabbage, health concern was found to influence WTP for safer lettuce positively and at significant level of 5%. Furthermore the marginal effect of health concern showed that, those who are not concerned so much about their health had 0.01, 0.03 and 0.03 higher probabilities of paying more for safer lettuce than those concern about their health. However, at a very high price Bid4, those who were concerned about their health had 0.08 higher probability of paying more than those who were not too concerned about their health. Health concern on the other hand has no influence on willing to pay for safer tomatoes.

Access to Information: For lettuce, the coefficient was found to also influence WTP negatively and was statistically significant at 5%. The negative coefficient implies, consumers' access to information on safer lettuce decreases with WTP . It is further revealed in the marginal analysis that, consumers' access to information on safer food increases the probability of willing to pay for Bid1 and Bid2 and Bid3 of safer lettuce by 0.01, 0.02 and 0.02 but decreases the WTP for Bid4 by 0.05. This suggests, beyond a certain price level, WTP for the 4^{th} bid of safer lettuce decreases though with consumers still getting access to information and also concern about their health.

Table 4.10: Estimated Coefficients and marginal effects of Determinants of WTP for safer lettuce.

Variables	SAFER LETTUCE					
	Coefficient	**No WTP**	**WTP Bid 1**	**WTP Bid 2**	**WTP Bid 3**	**WTP Bid 4**
Age	-0.3159**	0.0089	0.0184*	0.0489**	0.0384**	-0.1146**
Education	0.0486	-0.0012	-0.0026	-0.0073	-0.0062	0.0172
Occupation	0.7383	-0.0079	-0.0214**	-0.0783**	-0.0945	0.2023*
HH size	0.0816*	-0.0019	-0.0042*	-0.0121*	-0.0105*	0.0286*
Number of children (H)	-0.1864	0.0043	0.0096	0.0276	0.0239	0.0654
Income	0.7331***	-0.0038	-0.0593*	-0.1210***	-0.0636***	0.2817***
Appearance of veg	-0.0379	0.0008	0.0019	0.0055	0.0049	-0.0131
Trust in Government	0.0633	-0.0015	-0.0033	-0.0094	-0.0081	0.0222
Financial Risk	0.1169	-0.0027	-0.0060	-0.0173	-0.0150	0.0410
Health Concern	0.2268**	-0.0053	-0.0117**	-0.0335**	-0.0291**	0.0796**
Access to Information	-0.1372**	0.0032	0.0071**	0.0203**	0.0176**	-0.0482**

Model Fitness		**Defined boundaries for 1.kg of a bundle of safer lettuce WTP bids**
		No WTP=0
Number of observations	350	Bid 1 = WTP < CFA 250
LR chi2(11)	41.11	Bid 2 = CFA 250 < WTP < 400
Prob > chi2	0.000	Bid 3 = CFA 400 < WTP < CFA 700
Pseudo R2	0.1601	Bid 4 = WTP > CFA 700
Log pseudo likelihood	-321.49	

= significant at 10%, ** = significant at 5% and *** = significant at 1%

Source: Authors estimation from field Survey, 2016.

4.12: Determinants of Consumers' WTP for Safer tomatoes

Age: Like the other crops, the coefficient of age indicates a negative relationship between the variables and WTP, at a significant level of 5%. This meets the *a priori* expectation of the study and suggests that, consumer WTP decreases with an increase in age. Similarly the marginal effects revealed that, an increase in consumers' age by one year increases the probability of WTP for the lower bids of tomatoes by 0.07 and 0.04 respectively, but decreases for the final bid by 0.13.

Occupation: Unlike safer cabbage and lettuce, the coefficient and the marginal effects of the Bid 1, 3 and 4 of safer tomatoes were observed not to have influence on willingness to pay, while the marginal effect of WTP for Bid2 had a negative effect on willingness to pay for safer tomatoes. This suggests that salary earning workers have a lower probability of willing to pay for Bid2 of safer tomatoes by 0.09 at a significant level of 10%.

Income of Respondents: Similarly for tomatoes, income was observed to have positive relationship with WTP and was statistically significant at 1%. This suggests consumers' WTP for safer tomatoes increases with an increase in income. Also the marginal effects results revealed that, increase in consumers' income by one CFA decreases the probability of WTP for Bid2 and Bid3 of safer tomatoes by 0.21 and 0.06% respectively, but increases for at the final Bid4 by 0.36 at a significant level of 10%. This also meets the *a priori* expectation.

Trust in Government certification institution: This variable was operationalized by considering if consumers trust in government or otherwise could influence their WTP. It was dummied as 1 if a consumer has trust in government certification institution and 0 if

otherwise. It was found to be statistically significant at 1% and positively influence WTP for only safer tomatoes. It implies a direct relationship between WTP and trust in government and meets the *apriori* expectation of the study. Also the marginal values of Trust in government indicates that consumers who have trust in government have lower probability of willing to pay for safer tomatoes at Bid1, Bid2 and Bid3 by 0.003, 0.03 and 0.02 respectively but have higher probability of 0.7 for Bid4 compared to consumers who do not trust in government. This suggests that, for tomatoes a trust in government means higher WTP for higher bids and lower WTP for lower bids. An explanation to this could be that, consumers who have higher trust in government are prepared to pay more for safer lettuce vegetable.

Table 4.11: Estimated Coefficients and marginal effects of Determinants of WTP for safer tomatoes.

Variables	SAFER TOMATOES					
	Coefficient	No WTP	WTP Bid 1	WTP Bid 2	WTP Bid 3	WTP Bid 4
Age	-0.3331**	0.0092	0.0067	0.0685**	0.0406**	-0.1249**
Education	0.0761	-0.0018	-0.0014	-0.0150	-0.0098	0.0280
Occupation	0.6865	-0.0074	-0.0065	-0.0960*	-0.0949	0.2049
HH size	0.0109	-0.0002	-0.0002	-0.0021	-0.0014	0.0039
Number of children(H)	-0.0689	-0.0015	0.0012	0.0133	0.0091	-0.0252
Income	0.9369***	0.0576	-0.0314	-0.2132***	-0.0583***	0.3605***
Appearance of veg	-0.2889	0.0046	0.0038	0.0495	0.0403	-0.0982
Trust in Government	0.1811***	-0.0040	-0.0031*	-0.0352***	0.0238***	0.0661***
Financial Risk	0.1059	-0.0024	-0.0018	-0.0206	-0.0139	0.0387
Health Concern	0.1352	-0.0030	-0.0023	-0.0263	-0.0178	0.0494
Access to Information	-0.0902	0.0020	0.0015	0.0175	0.0118	-0.0329

Model Fitness		**Defined boundaries for 0.5kg of safer Tomatoes WTP bids**
Number of observations	350	No WTP=0 Bid 1 = WTP < CFA 150
LR chi2(11)	43.22	Bid 2 = CFA 150 < WTP < CFA 300
Prob > chi2	0.000	Bid 3 = CFA 300 < WTP < CFA 500
Pseudo R2	0.1634	Bid 4 = WTP > CFA 500
Log pseudo likelihood	-319.47	

= significant at 10%, ** = significant at 5% and *** = significant at 1%

Source: Authors estimation from field Survey, 2016.

4.13 Preferred purchasing Outlets/points for Safer Vegetables

The third objective was to determine the socioeconomic factors that influenced consumers' preferred purchasing outlet/points for safe vegetables. Three markets were predetermined for the study, namely; Roadside market, Super market and Farm gate. These markets were assumed to be mutually exclusive with roadside being the least prioritized (bottom) and super market the most (extreme). It should be noted that the emphasis is on consumers' preference (first choice) and not necessarily where they actually buy safe vegetables from. Results from Table 4.12 below reveal that, 52.6% prefer buying safe vegetables from the roadside market, 31.4% prefer buying the safe vegetables from the supermarket, while the remaining 16.0% prefer buying from the farm gate. This implies that majority of the population under study prefer buying from the roadside market to the other two markets. The findings, however, show that motivation to buy at the roadside market over the other markets is as a result of factors such as price, distance, easy access, the chance for negotiation and the possibility of buying other household goods which are easily accessible in the roadside market compared with the other markets. On the other hand, the 31.4% who prefer buying at the super market hold the view of higher tendency of the vegetable being safer than those of the other markets.

Table 4.12: preferred purchasing outlet for safer vegetables

Preferred purchasing outlet/point	Frequency (N=350)	Percentage (%)
Road side market	184	52.6
Super market	110	31.4
Farm gate	56	16.0
Total	350	100.0

Source: Computed from Household Survey Data, 2016.

4.13.1 Determinants of Consumers' Preferred purchasing Outlets/points.

A Multinomial logit was estimated to determine the factors, which influence the choice of preferred market. Assuming mutual exclusiveness of the markets, with roadside being the least prioritized (bottom) and super market the most (extreme). Roadside market is assumed to be least prioritized because the researcher thinks that it is where vegetables can easily be contaminated. For instance, at the farm gate the vegetables may not have passed through several hands and at the super market care would have been taken to sort out, clean and store the vegetables. The regression model is run with roadside as the base category in other to determine the relative effect of each particular predictor on the preferred purchasing outlets/point. Table 4.13 shows the coefficients and marginal effects from the Multinomial logit of urban consumers of vegetables choosing a particular type of market relative to the base category. The likelihood ratio is statistically significant at 1% and implies that at least, one of the explanatory variables in the model contributes to explaining the variation in the preferred purchasing outlet/points. Out of ten (10) predictors used in the estimation, seven (7) were found to be significant and influence consumers' preference for buying at the super market over the roadside market, four (4) variables were also found to have some influence on consumers' preference for buying at the farm gate over the roadside market. Other variables such as appearance of safe vegetables and distance to the market were found to have no influence on the preferred market of urban consumers of vegetables.

Table 4.13: Estimated Coefficients and Marginal Effects of Determinants of Preferred purchasing Outlets/points

Variable	Super Market		Farm gate Market		Roadside Market
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Marginal Effect
Sex	1.1631	0.1850*	0.2278	-0.0097	-0.1754
Marital status	1.1492***	0.1845***	0.6999	0.0445	-0.2289***
Education	0.8595**	0.1585***	0.1711	-0.0135	-0.1450**
Occupation	0.2291**	0.0388**	0.2070*	0.0163	-0.0552**
HH size	-0.2400***	-0.0390***	-0.2517***	-0.0217**	0.0607***
Income	4.6006*	9.4407**	7.8606	-1.2007	-8.2407
Appearance	-0.3846	-0.0794	-0.1387	0.0026	0.0768
Distance-to markets	0.0902	0.0168	0.0498	0.0022	-0.0191
Frequency-of purchasing	0.3116***	0.0461***	0.4201***	0.0406***	-0.0867***
Knowledge-of vegetable market	-0.9184**	-0.1402***	-1.0622***	-0.0881**	0.2283***
constant	-3.2252**		-1.9921		
Model fitness	**Super market/Farm gate**				
Number-of observations	350				
LR chi(20)	66.23				
Prob>chi2	0.0000				
Pseudo R2	0.0951				
Log likelihood	-315.1404				

Significant at 10%, ** = significant at 5% and * = significant at 1%*

Source: Authors estimation from field Survey, 2016.

Sex: Result from the analysis reveals that holding all other factors constant, when a selected sampled respondent is a female, the probability of preferring to shop at the super market increases by 0.19 as opposed to a male counterpart. However, Sex does not influence the preference for buying at the roadside market and the farm gate market. The survey result further revealed that, women frequently shop and are at the center stage of cooking compared to men and the former's preference for super market shopping.

Marital status*:* A respondent being a married person is also observed to positively influence consumers' choice of preferring to shop at the super market to the roadside market at a significant level of 1%. Similarly, the marginal effect estimates indicates that, the probability of preferring to buy at the super market by a married consumer is 0.18 higher and 0.23 lower in buying at the roadside market than an unmarried consumer. It suggests that the married had a greater probability of buying safe vegetables from supermarkets than the single. This confirms the *a priori* expectation of the study.

Education: The study revealed that being a literate positively influences one's preference for buying at the super market as opposed to the roadside market. Similarly, the marginal value of super market indicates the probability of a literate preferring to shop at the super market over an illiterate is higher by 0.16. While the probability of preferring to buy at the roadside market is lower by 0.15. Like other variables discussed above, it can be established from the result that, being an educated person has a direct effect on preference for shopping at the super market but an indirect effect on preference for buying at the roadside market. One of the explanations could be that, prices are pre-written on vegetables at the super markets, thus only the educated can read and write, hence revealing the inability of illiterates to buy from the super markets. This finding is consistent with that of Wolf *et al*, (2000) and Onianwa *et al*. (2006).

Occupation: This variable was dummied as 1 if a respondent is into a salary-earning job and 0 if otherwise. It is observed to be statistically significant at 5% and 10% for preference for buying at the super market and the farm gate. This suggests that, being in a salary-earning occupation increases preference for buying at both the super market and farm gate as opposed to the roadside market. Also, the marginal effect show that the

probability of a salary–earning occupation worker preferring to buy at the super market is higher by 0.04 while the probability of preference for buying at the roadside market is lower by 0.06 than the probability of the non-salary worker .This implies that, being a salary- worker directly influences preference for buying at the super market and inversely influences preference for buying at the roadside market. A possible explanation is that, salary workers receive regular incomes with which they can patronize the super markets goods. They also may not have the time to go to the farms to buy vegetables.

Household size: Household size was observed to negatively influence consumers' preference in buying both at the super market and the farm gate over the roadside market at a significant level of 1%. This implies, increase in household size by one member reduces the preference for buying safer vegetables at both the super market and the farm gate. Similarly, the marginal effect shows, an increase in household size by one member increases the probability of preference for buying at the roadside by 0.06, holding other determinants constant. However, the marginal values of super market and farm gate mean that an increase in household size by a member decreases the probability of preference for buying at the super market and the farm gate by 0.04 and 0.02 respectively. An explanation to this could be that, larger households have many mouths to feed and thus prefer to buy at the roadside which is mostly assumed to have lower prices compared to the other two markets. This finding confirms the earlier studies of Kezis et al. (1998) and Wolf et al, (2005), who indicated that, increase in household size decrease consumers preference for purchasing at the super markets.

Income: Income was also found to positively influence consumer preference for buying at the super market over the roadside market at a significant level of 10%. This implies an increase in consumers' income by one CFA results in an increase in preference for buying at the super market over the roadside market. Similarly, the marginal effect of income showed that, increases in consumers' income by one CFA, increases the probability of preferring to buy at the super market by 1. This implies high income earners are more likely to prefer shopping at the super market over the other two markets. The results on the other hand show that, income does not influence the preference for buying at the roadside and the farm gate markets. With a mentality that goods at the super market are more costly compared to goods at the roadside market, a possible explanation to this may be that, only consumers with higher income can buy at the super market. This meets the *a priori* expectation and also concurs with the study of Wolf *et al.,* (2005) and Onianwa *et al*., (2006.) who stated that, increase in income directly influence preference for buying at the super market.

Frequency of purchasing vegetables: Frequency of purchase was measured as a dummy variable where 1 is assigned if a consumer purchases vegetables daily, and 0, if otherwise. It has positive influence on consumer preference for buying both at the super market and the farm gate over the roadside market and was statistically significant at 1%. In addition, the marginal effect showed that, Frequent shoppers have greater probabilities of buying from the super market (0.05) and farm gate (0.04) than the road side (-0.09). This is contrary to the apriori expectation because it was thought that consumers who shopped frequently would prefer to shop at the road side where vegetables are believed to be commonest.

Knowledge of vegetable market: Knowledge of vegetables markets was observed to negatively influence preference for buying both at the super market and the farm gate to the roadside market at significant levels of 5% and 1% respectively. This suggests that an increase in consumers' knowledge of the availability of safe vegetable markets decreases the preference for buying at both the super market and the farm gate, compared with roadside market. This finding however, did not meet the *a priori* expectation of the study. Also the marginal effect values show that, the probability of shopping at the road side (0.23) by those who have knowledge about existing markets is greater than that of the super markets (-0.14) and farm gate (-0.09).

4.14 Ranked Constraints to Accessing safe vegetables

Objective four was to identify and rank the constraints consumers' face in accessing safe vegetables. The Garrett ranking technique was used in this regard. The identification of these constraints to accessing safer vegetables was done through a review of existing literature on willingness to pay for safe, organic and inorganic foods in West Africa. Six major constraints were identified and presented for ranking. To allow for in-built test of agreement, the constraints were presented to each respondent to identify the one that affects him or her before ranking it. The mean scores are found per those who rank a particular constraint and then used for policy recommendations for a diverse population. The discussion of the constraint was done using the aggregated (pooled) constraints in a decreasing order of merit.

Table 4.14: Ranked Potential Constraints to accessing safer vegetables

No	Potential Constraints	Mean Garrett Score				Ranks			
		Cabbage	Lettuce	Tomatoes	Pooled	Cabbage	Lettuce	Tomatoes	Pooled
1	Inadequate supply of safe vegetables	60.48	62.76	49.28	57.50	1	1	1	1
2	Lack of trust in market vendors	50.62	49.00	47.15	48.92	4	2	4	2
3	Distance to the purchasing outlet/point of safe vegetables	52.49	42.63	47.69	47.60	3	4	3	3
4	Price of safe vegetables	45.16	47.83	47.96	46.98	5	3	2	4
5	Lack of information on safe vegetables	55.57	41.64	39.02	45.41	2	5	6	5
6	Cultural barriers	36.93	40.91	40.21	39.35	6	6	5	6

Source: Authors estimation from field Survey, 2016.

Inadequate supply of safe vegetables: With a Garrett mean score of 57.50, inadequate supply of safe vegetables was the most pressing constraint in accessing safe vegetables in Ouagadougou. Urban consumers of vegetables lament of the inadequate supply of safe vegetables leading to black marketing, thus providing opportunity for suppliers of vegetables (unsafe) to charge higher prices. The consequence of this is the access of safe vegetables to only the rich, thus exposing the poor to potential diseases from the consumption of the unsafe vegetables. This finding concurs with other findings of Dimitri and Richman, 2000; and Gil *et al.,* 2000 who indicated that, especially in the developed world, higher product prices and unavailability in the supermarket are the major constraints facing the purchasing of safe and organic food products . The

implication of this is that, there is potential market for the safer vegetables that the Urban Food ^{Plus} project plans to produce in Burkina Faso.

***Lack of trust in market vendors**:* With a mean score of 48.92, lack of trust in market vendors was the second ranked constraint. Consumers perceive that vegetable vendors are driven by profit motives; consequently, they charge high prices for vegetables under the pretense that the vegetables are safe. Some of the consumers however, indicated that this practice which used to be very much common has now reduced because of state broadcast of market prices of some vegetables (e.g. lettuce).

Distance to the purchasing outlet/point of safe vegetables: The third most pressing constraints ranked was distance to the purchasing outlet/point of safe vegetables and has a mean score of 47.60. According to the respondents, even though there are a number of small market centers in Ouagadougou, they are not well developed hence do not look attractive. The bigger ones (Market Sangariare), that they wish to go to are far and so they spend a lot on transport going there to buy vegetables.

Prices of safe vegetables: With a Garrett mean score of 46.98 higher prices was the fourth pressing constraint in accessing safe vegetables. The consumers complained that the safe vegetables were much more expensive than the conventional ones. Thus, not all of them are able to buy them. This finding is in line with that of Nandi *et al.* (2016) which show that, unavailability and higher prices, are the overall challenges to organic food purchase. It is also consistent with the findings of Dimitri and Richman, (2000) and Gil *et al.*, (2000) who stated price as the main challenge in accessing safe foods.

Lack of adequate information on safe vegetables: The fifth ranked constraint is the lack of adequate information on safe vegetables and has a Garrett mean score of 45.41.Though many respondents expressed interest in their WTP for safer vegetables, they complained about inadequate information on safe vegetables. The survey further revealed that, poor media system coupled with high cost of accessing information on the internet is one of the country's developmental challenges, especially in view of the language used in disseminating information. The consequence of this constraint is that, only a few get access to information on safe vegetables.

Cultural barriers: The last ranked constraint is cultural barrier with a mean score of 39.35. This constraint was community-specific and was ranked by only three (3) communities out of the ten (10) randomly selected communities, namely Sandogo, Tanguin and Wayalgiun where cultural issues are paramount. According to the respondents from these communities, their culture does not allow women to buy from the super markets which are perceived as foreign shops where genetically modified foods are sold. Thus, buying at the super market is a taboo.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a summary of the main findings, conclusions drawn, recommendations emanating from the study and suggestions made for future research.

5.1 Summary

The study examined consumers' willingness to pay for safer vegetables in Ouagadougou, Burkina Faso. Specifically, it examined factors consumers consider when buying vegetables, how much consumers were WTP for safer vegetables, factors influencing their WTP, Preferred Purchasing outlets and the constraints to accessing safe vegetables in Ouagadougou, Burkina Faso.

Multi-stage sampling technique was used to sample 350 respondents; a comprehensive semi-structured questionnaire was then used via face-to-face interview to collect data for the analysis. Contingent valuation method (CVM) using a hybrid of open ended and two stage process of elicitation (double bound) approaches were used to elicit the amount consumers were willing to pay for safer vegetables. Furthermore, Ordered probit model, Multinomial logit model and Henry Garret ranking techniques were used to analyse factors influencing consumers' WTP, factors influencing consumers' preferred purchasing outlet/point and the constraints consumers face in accessing safe vegetables respectively. Descriptive statistics was used to present factors consumers considered when buying vegetables, and the socio-demographic characteristics of the sampled respondents.

5.2 Major Findings of the Study

The major findings from the study are as follows:

- Willingness of urban consumers to pay more for safer vegetables in Ouagadougou the capital town of Burkina Faso was very high with a percentage of 98.6%. Only a few (1.4%) were unwilling to pay for the proposed safer ones.
- The amount consumers were willing to pay for all the three selected vegetables if safer were high with mean amounts of CFA 322(GH¢2.3), CFA 400(GH¢2.8), CFA 265(GH¢1.9) for an average size 1.5kg of cabbage, 1kg of a bundle lettuce and 1kg of tomatoes representing 63.5%, 100% and 59.0% increments.
- Variables such as education, occupation, household size, income, consumers' willingness to risk his or her finances and consumers' concern with their health, were found to positively influenced WTP for safer vegetables, while respondents' age, appearance of vegetables and access to information influenced WTP negatively.
- Also, respondents' marital status, education, occupation, income and frequency of purchase, were found to positively influence consumers' preference for shopping at the super market over the roadside market. On the other hand, household size and respondents' knowledge of vegetable market negatively influenced consumers' choice for buying at the super markets over roadside markets.
- Inadequate supply of safe vegetables was ranked first as the highest constraint faced by urban consumers of vegetables while cultural barriers ranked as the least constraint to accessing safe vegetables.

5.3 Conclusions of the Study

Based on the findings, the following conclusions are drawn from the study.

- Consumers' WTP was high (mean WTP) for safer vegetables, indicating the prospects for safer vegetables.
- The most preferred purchasing outlets for the rich, the educated and people in salary-earning occupation is the super market while, the poor and larger households prefer mostly the roadside market.
- The major constraint facing urban consumers of vegetables in Ouagadougou, Burkina Faso, is the inadequate supply of safe vegetables. The implication of this is that there is potential market for the safer vegetables that the Urban Food Plus project plans to produce in Burkina Faso.

5.4 Policy Recommendations

- Based on the findings, the study recommends that stakeholders such as (NGO's) should finance farmers, so as to venture into production and selling of safer vegetables.
- Since increase in consumer consciousness about health and food safety has direct influence on WTP especially for the higher bids, there should be keen efforts by stakeholders (Nutrionist) to create consumer awareness about the health implications of consuming safer vegetables
- There should be a good and credible product labeling to assist consumers to differentiate safer vegetables on the market from unsafe ones.

5.5 Suggestions for Future Research

- It is suggested for future research to consider WTP for safer vegetables on other vegetables so as to determine the factors that may influence the WTP for them. This will help in determining the major factors that influence the buying of safer vegetables in Ouagadougou in general.
- Further studies could also examine willingness to pay for safer fruits and the potential constraints in accessing safer fruits, since fruit and vegetables are complements.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE FOR HOUSEHOLD SURVEY

SURVEY QUESTIONNAIRE

Consumers' Willingness to Pay for Safer Vegetables in Ouagadougou, Burkina Faso

Serial Number _____ Date of Interview _____

District _____

PART I

GENERAL HABITS OF CONSUMPTION AND FOOD-RELATED ATTITUDES

In this section of the questionnaire, I am going to ask you few questions about your consumption habits

1. How much does your household spend on the following categories of food?

Food Item	***Average Frequency of Shopping*** **1** if Daily, **2** if Weekly, **3** if Fortnightly, **4** if Monthly **5** if Once every 2 months **6** if Other(s) _____	***Average Amount per Shopping (CFA)***	***Amount Spent per Week (CFA)*** *[To be computed by interviewer]*
Staple Crops (e. g. rice and rice products)			
Meat and Fish			
Beverages (non-alcoholic or alcoholic)			
Fruits			
Vegetables			
Other			
Total household expenditure on groceries/foodstuffs *[computed by interviewer]*			

2. Does the appearance (e. g. cleanliness, smell, colour, texture) of vegetables positively influence your buying decision?

Yes ☐ No ☐ Do not know ☐

3. Does the nutritional value of vegetables (e. g. amount of vitamins etc.) positively influence your buying decision?

Yes ☐ No ☐ Do not know ☐

4. Vegetable production involves using irrigation water from different sources, such as fresh water, piped water, water from the river/ponds/streams/wells etc. Depending on where the irrigation water comes from, your health and the health of your family might be influenced in a negative way. Does the source of irrigation water for vegetable production influence your buying decision?

Yes ☐ No ☐ Do not know ☐

5. The excessive use of agrochemicals, such as herbicides, pesticides and chemical fertilizer, might have a negative influence on your health and the health of your family. In purchasing vegetables, are you concerned as to whether or not they were produced using agrochemicals?

Yes ☐ No ☐ Do not know ☐

PART II

ELICITATION OF HOW MUCH CONSUMERS ARE WILLING TO PAY FOR SAFE VEGETABLES

In this section, I would like to find out what you think about certain vegetable production methods. There are no correct or false answers. I will now give you some information on vegetable production methods and their consequences on human health.

Vegetable production in Burkina Faso is often characterized by wastewater irrigation and excessive use of agrochemicals (chemical fertilizers and pesticides). Untreated wastewater may contain pathogens, such as pesticide residues, which may contaminate agricultural produce. The consumption of this produce (e. g. vegetables) may cause human health risks, such as diarrhea or typhoid.

Methods to clean wastewater, such as water filtration, will reduce pathogen load to a level where the consumption of agricultural produce is safe, i. e. not harmful to human health.

The cost of water filters will increase the production costs for farmers. These farmers would have to pass on part of that cost to the consumers, resulting in higher prices for safe vegetables compared to unsafe ones.

6. of safer vegetables *[use the table below]*.

Category	Location	Safe Vegetables
Have you ever purchased vegetables in Ouagadougou at these markets?	Market Supermarket Farm gate	Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐
What is the Frequency of purchase		Daily ☐ Weekly ☐ Monthly ☐ Occasionally ☐
Do you have any knowledge of the availability of safer vegetables at these markets in Ouagadougou?	Market Supermarket Farm gate	Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐
Which of these markets in Ouagadougou would you prefer to purchase safer vegetables? please tick only one(1) of the most preferred.	Market Supermarket Farm gate	Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐

7. Are you concern about the quality of your health when buying vegetables

Yes ☐ No ☐

8. If yes to 7, would you be willing to pay more for vegetables that are safer and thus, not harmful to your health? *[Before answering this question, please take into consideration that your budget is constraint. If you are willing to pay higher prices for safe vegetables, you may have to reduce the expenditures for your other needs.]*

Yes ☐ No ☐

9. If no to **7,** why? [*multiple answers are possible*]

- I cannot afford buying the safe vegetables ☐
- I think that vegetables conventionally produced are safe ☐
- I know that my market vendor only sells me safe vegetables ☐
- Other reason **(**please explain _____ **)**

[If yes to 8, please proceed with the following]

[The current market price for 1.5kg average sized cabbage is CFA _____]
[The current market price for one (1) bundle of lettuce is CFA_____]
[The current market price for 0.5kg (500g) *of tomatoes is CFA _____]*

[Note to the interviewer: The current market prices of the vegetables above serve as a start-up price for the WTP elicitation. Top-up the current market price randomly by 125%, 150%, 175% or 200% and manually write the concrete amounts in the blank spaces provided in the table below. If the respondent answers "yes" to the first bid, the second bid is set higher by randomly assigning a price premium (10%, 20%, 30%, 40% or 50%) on the initial price premium. If the respondent answers "no" to the first bid, the second bid is set lower by randomly assigning respondents a discount (10%, 20%, 30%, 40% or 50%) on the initial price premium.

Question	**Safe vegetable**		
	one average sized cabbage	*one bundle of lettuce*	*four pieces of tomatoes*
10. If safer, will you be willing to pay	CFA _____ Yes ☐ No ☐	CFA _____ Yes ☐ No ☐	CFA _____ Yes ☐ No ☐
11. If yes to **10.**, will you be willing to pay	CFA _____ Yes ☐ No ☐	CFA _____ Yes ☐ No ☐	CFA _____ Yes ☐ No ☐
12. If no to **10.**, will you be willing to pay	CFA _____ Yes ☐ No ☐	CFA _____ Yes ☐ No ☐	CFA _____ Yes ☐ No ☐
13. If you answered yes to **10.** What is the highest amount you are willing to pay for safer vegetables?	CFA _____	CFA _____	CFA _____

14. Please indicate why you are willing to pay more for safe vegetables.
[Please tick the appropriate option for each statement].

Statement	Yes	No	Do not know
I can afford buying safe vegetables			
Safe vegetables are more nutritious (e. g. vitamins, minerals) than the conventional ones			
Safe vegetables are tastier than conventional ones			
Safe vegetables are healthier for me and my family than the conventional ones			

15. please rank the three constraints which are most pressing in accessing safe vegetables (1 = most pressing).

Constraint	Rank the three most pressing constraints
Prices of safe vegetables	
Lack of adequate information on safe vegetables	
Lack of access to markets for safe vegetables (Distance)	
Lack of safe vegetables	
Lack of trust in the market vendor	
Cultural barriers	

PART III

ELICITATION OF TRUST

16. How much trust do you have in the following persons/institutions? Please rate your level of trust. [*Please tick the appropriate for each institution/person.*]

Institutions/ Persons	***Do not trust at all*** *(1)*	***Do not trust very much*** *(2)*	***Neutral*** *(3)*	***Trust somewhat*** *(4)*	***High trust*** *(5)*
government					
public authorities					
farmers					
traders					
private institutions					
scientific institutions					
strangers					
ethnicities: Peul					
Lobi					
Bobo					
Mossi					
Other:					
neighbour					
friends					
family					

PART IV

DEMOGRAPHIC CHARACTERISTICS

17. Religion of Respondent:

Traditional ☐ Christian ☐ Muslim ☐ Other ☐

18. Marital Status of Respondent:

Single ☐ Married ☐ Divorced ☐

19. Please indicate the composition of your household (resident household members only!) *[use the table below]*

HH members *(first names only)*		**Relationship to the respondent**	**Age**	**Sex M/F**	**Highest Education**[1]	**Major occupation** *(Activity you spend most of your time on)*	**Earnings/ Month (CFA)**
Respondent							
Household Head							

(1) None, (2) Koranic school, (3) Non-formal (can read and write but never went to school), (4) primary class (1-6), (5) Junior High School (JHS1 – JHS3) (6) Secondary (SHS1-SHS3, Vocational or Technical School, (7) Tertiary (Training college, university, polytechnic)

(1) Own farm, (2) daily wage labour (farming or non-farm activities), (3) salaried worker (e. g. teacher, police man), (4) petty trading, (5) craftsman (e. g. bricklayer, carpenter, tailor), (6) Student, (7) Other **(***Please specify:*)

20. What is your ethnicity? Mossi ☐ Peul ☐ Bobo ☐ Senufo ☐ Gurunsi ☐

Other **(***Please specify*_____ **)**

PART V

ELICITATION OF RISK PREFERENCES

21. Please indicate whether you are willing to take risk. [*Please tick the appropriate option for each category.*]

Category	***No*** *(1)*	***Neutral*** *(2)*	***Yes*** *(3)*
financial matters			
your occupation			
your health			

22. Consider the following situation: Suppose that your child has a whole in his heart. An international donor organization offers you the opportunity to collect money for a surgery. There is a chance that the surgery will fully cure your son's heart. Nevertheless, there is also a chance that your son will be dying immediately after the surgery. How would you decide? Please indicate the lowest probability you would consider acceptable for doing the surgery.

It is nearly certain that the surgery will be successful ☐
There is a 50-50 chance that the surgery will be successful ☐
There is small chance that the surgery will be successful ☐

23. Do you have any further comments on the topic of safer vegetables?

_____

_____

_____

24. Do you have any questions for me?

…….Thank You Very Much for Your Co-operation…….

APPENDIX 2: ESTIMATED OUTPUTS OF DETERMINANTS OF WILLINGNESS TO PAY (WTP)

Ordered probit regression — Number of obs = 350; LR chi2(11) = 74.24; Prob > chi2 = 0.0000; Log likelihood = -425.79744; Pseudo R2 = 0.0802

o_cabbage	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Age13	-.3130975	.1382531	-2.26	0.024	-.5840687	-.0421263
educcat	.3589245	.1427868	2.51	0.012	.0790674	.6387815
occup18	.972916	.484287	2.01	0.045	.023731	1.922101
HHmember	.0657658	.03943	1.67	0.095	-.0115156	.1430472
numberofkidscat	-.1220805	.1349858	-0.90	0.366	-.3866479	.1424868
Eanings	.667699	.2645933	2.52	0.012	.1491056	1.186292
appearance_veg	-.8481358	.5141101	-1.65	0.099	-1.855773	.1595014
gov	.0928195	.0620149	1.50	0.134	-.0287274	.2143665
financial_risk	.2932913	.0756749	3.88	0.000	.1449712	.4416114
health_C	.1739477	.0846298	2.06	0.040	.0080764	.3398191
A_information	-.1021719	.0522635	-1.95	0.051	-.2046065	.0002627
/cut1	-1.248889	.6802201			-2.582096	.0843183
/cut2	-.3378474	.6640822			-1.639425	.9637297
/cut3	.7820296	.6653938			-.5221182	2.086177
/cut4	1.597799	.6678274			.2888818	2.906717

Marginal effects after oprobit
y = Pr(o_cabbage==0) (predict, outcome(0))
= .00653482

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.0070494	.00478	1.48	0.140	-.002311	.01641	.257143
educcat*	-.0085733	.00563	-1.52	0.128	-.019617	.00247	.774286
occup18*	-.0066045	.00349	-1.89	0.058	-.013437	.000228	.02
HHmember	-.001206	.0009	-1.34	0.182	-.002976	.000564	5.26857
number~t	.0022387	.00267	0.84	0.402	-.002996	.007473	1.75143
Eanings*	-.0262277	.02022	-1.30	0.195	-.065854	.013398	.945714
appear~g*	.0063069	.00337	1.87	0.061	-.000293	.012907	.985714
gov	-.0017021	.00136	-1.25	0.212	-.004374	.00097	4.34571
financ~k	-.0053784	.00278	-1.94	0.053	-.010825	.000068	2.36
health_C	-.0031899	.00211	-1.51	0.131	-.007329	.000949	1.4
A_info~n	.0018737	.00128	1.47	0.142	-.00063	.004377	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Marginal effects after oprobit
y = Pr(o_cabbage==1) (predict, outcome(1))
= .05157686

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.0340249	.01751	1.94	0.052	-.000285	.068335	.257143
educcat*	-.0401633	.019	-2.11	0.034	-.077396	-.00293	.774286
occup18*	-.0480057	.01277	-3.76	0.000	-.073042	-.022969	.02
HHmember	-.0064341	.00399	-1.61	0.107	-.014251	.001383	5.26857
number~t	.0119436	.01338	0.89	0.372	-.014275	.038162	1.75143
Eanings*	-.0935227	.04932	-1.90	0.058	-.190193	.003147	.945714
appear~g*	.0451803	.01425	3.17	0.002	.017255	.073106	.985714
gov	-.0090809	.00625	-1.45	0.146	-.021333	.003171	4.34571
financ~k	-.0286938	.00864	-3.32	0.001	-.045636	-.011752	2.36
health_C	-.017018	.00875	-1.94	0.052	-.034171	.000135	1.4
A_info~n	.0099959	.00536	1.87	0.062	-.000509	.0205	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

. mfx compute, predict(outcome(2))

Marginal effects after oprobit
y = Pr(o_cabbage==2) (predict, outcome(2))
= .26790193

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.074949	.03283	2.28	0.022	.010604	.139294	.257143
educcat*	-.0851982	.0335	-2.54	0.011	-.150858	-.019538	.774286
occup18*	-.198347	.06704	-2.96	0.003	-.329738	-.066956	.02
HHmember	-.0160601	.00976	-1.65	0.100	-.035186	.003066	5.26857
number~t	.0298122	.03304	0.90	0.367	-.034948	.094573	1.75143
Eanings*	-.138811	.04176	-3.32	0.001	-.220668	-.056954	.945714
appear~g*	.1798518	.08067	2.23	0.026	.021732	.337972	.985714
gov	-.0226666	.0153	-1.48	0.139	-.052657	.007323	4.34571
financ~k	-.0716221	.0199	-3.60	0.000	-.110626	-.032618	2.36
health_C	-.0424782	.02099	-2.02	0.043	-.083625	-.001332	1.4
A_info~n	.0249505	.01298	1.92	0.055	-.000484	.050385	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(3))

Marginal effects after oprobit
      y  = Pr(o_cabbage==3) (predict, outcome(3))
         =  .31636429
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	-.0030547	.00728	-0.42	0.675	-.017324	.011214	.257143
educcat*	.0058549	.00919	0.64	0.524	-.012167	.023877	.774286
occup18*	-.1186046	.09048	-1.31	0.190	-.295937	.058728	.02
HHmember	-.0008474	.00133	-0.64	0.525	-.003462	.001767	5.26857
number~t	.001573	.0029	0.54	0.587	-.004102	.007248	1.75143
Eanings*	.0468816	.03923	1.19	0.232	-.030016	.123779	.945714
appear~g*	.0968014	.09371	1.03	0.302	-.086875	.280478	.985714
gov	-.0011959	.00192	-0.62	0.532	-.00495	.002558	4.34571
financ~k	-.003779	.00555	-0.68	0.496	-.014664	.007106	2.36
health_C	-.0022413	.00346	-0.65	0.517	-.009028	.004546	1.4
A_info~n	.0013165	.00203	0.65	0.518	-.002671	.005304	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(4))

Marginal effects after oprobit
      y  = Pr(o_cabbage==4) (predict, outcome(4))
         =   .3576221
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	-.1129687	.04795	-2.36	0.018	-.206957	-.01898	.257143
educcat*	.1280799	.0483	2.65	0.008	.033421	.222739	.774286
occup18*	.3715618	.16282	2.28	0.022	.052438	.690685	.02
HHmember	.0245476	.01473	1.67	0.096	-.004316	.053411	5.26857
number~t	-.0455675	.05041	-0.90	0.366	-.14437	.053235	1.75143
Eanings*	.2116799	.06645	3.19	0.001	.081436	.341924	.945714
appear~g*	-.3281404	.18368	-1.79	0.074	-.688151	.03187	.985714
gov	.0346456	.02316	1.50	0.135	-.010751	.080042	4.34571
financ~k	.1094732	.02823	3.88	0.000	.054145	.164801	2.36
health_C	.0649273	.03165	2.05	0.040	.002902	.126953	1.4
A_info~n	-.0381365	.01953	-1.95	0.051	-.076406	.000133	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Ordered probit regression — Number of obs = 350; LR chi2(11) = 41.11; Prob > chi2 = 0.0000; Log likelihood = -321.49667; Pseudo R2 = 0.0601

o_lettuce	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Age13	-.3159159	.1541513	-2.05	0.040	-.6180469	-.013785
educcat	.0486085	.1627689	0.30	0.765	-.2704126	.3676296
occup18	.7382543	.6162895	1.20	0.231	-.4696509	1.946159
HHmember	.0815819	.0453398	1.80	0.072	-.0072825	.1704464
numberofkidscat	-.1863969	.1555212	-1.20	0.231	-.4912128	.118419
Eanings	.7330789	.2710323	2.70	0.007	.2018654	1.264292
appearance_veg	-.0379291	.5455586	-0.07	0.945	-1.107204	1.031346
gov	.063263	.0694852	0.91	0.363	-.0729256	.1994515
financial_risk	.1168718	.0828825	1.41	0.159	-.0455749	.2793185
health_C	.2267772	.1041422	2.18	0.029	.0226623	.4308921
A_information	-.1371951	.0596919	-2.30	0.022	-.2541891	-.0202011
/cut1	-1.122368	.7307109			-2.554535	.3097991
/cut2	-.5683638	.7193772			-1.978317	.8415895
/cut3	.1816959	.7193018			-1.22811	1.591502
/cut4	.755996	.7199177			-.6550168	2.167009

Marginal effects after oprobit

y = Pr(o_lettuce==0) (predict, outcome(0))

= .0085649

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.0089602	.00627	1.43	0.153	-.003337	.021257	.257143
educcat*	-.0011682	.00406	-0.29	0.773	-.009121	.006784	.774286
occup18*	-.0079709	.00437	-1.82	0.068	-.016536	.000594	.02
HHmember	-.0018987	.00133	-1.43	0.154	-.004506	.000709	5.26857
number~t	.0043381	.00405	1.07	0.284	-.003606	.012282	1.75143
Eanings*	-.0377725	.02741	-1.38	0.168	-.0915	.015955	.945714
appear~g*	.0008449	.01163	0.07	0.942	-.021954	.023644	.985714
gov	-.0014723	.00173	-0.85	0.394	-.004854	.00191	4.34571
financ~k	-.00272	.00224	-1.22	0.224	-.007104	.001664	2.36
health_C	-.0052778	.00322	-1.64	0.102	-.011595	.001039	1.4
A_info~n	.003193	.00191	1.67	0.094	-.000543	.006929	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(1))

Marginal effects after oprobit
      y  = Pr(o_lettuce==1) (predict, outcome(1))
         =  .02506712
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.0183775	.01107	1.66	0.097	-.003323	.040078	.257143
educcat*	-.0025569	.00877	-0.29	0.770	-.019736	.014622	.774286
occup18*	-.0214463	.00996	-2.15	0.031	-.04097	-.001922	.02
HHmember	-.004202	.00255	-1.65	0.099	-.009199	.000795	5.26857
number~t	.0096005	.00834	1.15	0.250	-.006746	.025947	1.75143
Eanings*	-.0593129	.03268	-1.81	0.070	-.12337	.004744	.945714
appear~g*	.0018973	.02649	0.07	0.943	-.050028	.053823	.985714
gov	-.0032584	.00367	-0.89	0.374	-.010445	.003928	4.34571
financ~k	-.0060196	.00452	-1.33	0.183	-.014873	.002834	2.36
health_C	-.0116804	.0061	-1.92	0.055	-.023629	.000268	1.4
A_info~n	.0070664	.00353	2.00	0.045	.000153	.01398	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
Marginal effects after oprobit
      y  = Pr(o_lettuce==2) (predict, outcome(2))
         =  .10647335
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.0488671	.02543	1.92	0.055	-.000984	.098718	.257143
educcat*	-.0072556	.02455	-0.30	0.768	-.055378	.040867	.774286
occup18*	-.0783346	.04111	-1.91	0.057	-.158912	.002242	.02
HHmember	-.0120669	.00682	-1.77	0.077	-.02544	.001306	5.26857
number~t	.0275702	.02317	1.19	0.234	-.017837	.072978	1.75143
Eanings*	-.1210213	.04715	-2.57	0.010	-.213429	-.028613	.945714
appear~g*	.0055366	.07856	0.07	0.944	-.148429	.159502	.985714
gov	-.0093573	.01034	-0.90	0.366	-.029631	.010917	4.34571
financ~k	-.0172867	.01246	-1.39	0.165	-.041709	.007135	2.36
health_C	-.0335429	.01586	-2.11	0.034	-.064629	-.002457	1.4
A_info~n	.0202927	.00917	2.21	0.027	.002326	.03826	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(3))

Marginal effects after oprobit
      y  = Pr(o_lettuce==3) (predict, outcome(3))
         =  .16648235
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.0383672	.01836	2.09	0.037	.002377	.074358	.257143
educcat*	-.0061975	.02061	-0.30	0.764	-.046598	.034203	.774286
occup18*	-.0945096	.06843	-1.38	0.167	-.228638	.039619	.02
HHmember	-.0104747	.00605	-1.73	0.084	-.022337	.001388	5.26857
number~t	.0239323	.02034	1.18	0.239	-.01593	.063794	1.75143
Eanings*	-.0635927	.01436	-4.43	0.000	-.091737	-.035448	.945714
appear~g*	.0049113	.07121	0.07	0.945	-.134655	.144477	.985714
gov	-.0081226	.00901	-0.90	0.367	-.025773	.009528	4.34571
financ~k	-.0150057	.01089	-1.38	0.168	-.036342	.006331	2.36
health_C	-.0291169	.01409	-2.07	0.039	-.056733	-.001501	1.4
A_info~n	.0176151	.00814	2.16	0.030	.001664	.033566	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(4))

Marginal effects after oprobit
      y  = Pr(o_lettuce==4) (predict, outcome(4))
         =  .69341229
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	-.114572	.0573	-2.00	0.046	-.22688	-.002264	.257143
educcat*	.0171783	.0579	0.30	0.767	-.096298	.130655	.774286
occup18*	.2022614	.11747	1.72	0.085	-.027978	.432501	.02
HHmember	.0286422	.01589	1.80	0.071	-.002498	.059782	5.26857
number~t	-.0654412	.05454	-1.20	0.230	-.172335	.041452	1.75143
Eanings*	.2816994	.10556	2.67	0.008	.074799	.4886	.945714
appear~g*	-.0131901	.18787	-0.07	0.944	-.381414	.355034	.985714
gov	.0222107	.02439	0.91	0.362	-.025586	.070007	4.34571
financ~k	.0410319	.02911	1.41	0.159	-.016014	.098078	2.36
health_C	.0796181	.03639	2.19	0.029	.0083	.150936	1.4
A_info~n	-.0481671	.02092	-2.30	0.021	-.089165	-.007169	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Ordered probit regression — Number of obs = 350; LR chi2(11) = 43.22; Prob > chi2 = 0.0000; Log likelihood = -319.46782; Pseudo R2 = 0.0634

o_tomatoes	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Age13	-.3330524	.1524835	-2.18	0.029	-.6319146	-.0341902
educcat	.0760987	.1609186	0.47	0.636	-.2392959	.3914934
occup18	.6864501	.5970255	1.15	0.250	-.4836983	1.856599
HHmember	.0108654	.0430557	0.25	0.801	-.0735222	.095253
numberofkidscat	-.0689285	.1517716	-0.45	0.650	-.3663954	.2285383
Eanings	.9368727	.272352	3.44	0.001	.4030727	1.470673
appearance_veg	-.2889033	.5543377	-0.52	0.602	-1.375385	.7975787
gov	.1811003	.066783	2.71	0.007	.050208	.3119926
financial_risk	.1059307	.0827297	1.28	0.200	-.0562166	.268078
health_C	.1351736	.0986633	1.37	0.171	-.0582029	.3285501
A_information	-.0902213	.0591357	-1.53	0.127	-.2061252	.0256825
/cut1	-.87309	.7320911			-2.307962	.5617823
/cut2	-.6222374	.7228801			-2.039056	.7945815
/cut3	.4955714	.7169176			-.9095612	1.900704
/cut4	1.108479	.7196378			-.3019853	2.518943

```
.
. mfx compute,predict(outcome(0))

Marginal effects after oprobit
      y  = Pr(o_tomatoes==0) (predict, outcome(0))
         =  .00814346
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.0091584	.00617	1.48	0.138	-.00293	.021247	.257143
educcat*	-.0017831	.00403	-0.44	0.658	-.009678	.006112	.774286
occup18*	-.0074022	.00426	-1.74	0.082	-.015752	.000947	.02
HHmember	-.0002419	.00097	-0.25	0.802	-.002134	.00165	5.26857
number~t	.0015347	.00344	0.45	0.656	-.005214	.008283	1.75143
Eanings*	-.0576301	.03668	-1.57	0.116	-.129528	.014268	.945714
appear~g*	.0046331	.0064	0.72	0.469	-.007908	.017174	.985714
gov	-.0040321	.00227	-1.78	0.076	-.008483	.000418	4.34571
financ~k	-.0023585	.00208	-1.13	0.257	-.006437	.00172	2.36
health_C	-.0030096	.00252	-1.19	0.233	-.007956	.001937	1.4
A_info~n	.0020087	.00156	1.29	0.199	-.001055	.005072	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(1))

Marginal effects after oprobit
      y  = Pr(o_tomatoes==1) (predict, outcome(1))
         =  .00757219
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.00665	.00473	1.41	0.160	-.002623	.015923	.257143
educcat*	-.0013563	.00304	-0.45	0.656	-.007323	.00461	.774286
occup18*	-.0064934	.00412	-1.58	0.115	-.014564	.001577	.02
HHmember	-.0001864	.00074	-0.25	0.802	-.001644	.001271	5.26857
number~t	.0011823	.00266	0.44	0.657	-.004037	.006402	1.75143
Eanings*	-.0313885	.01963	-1.60	0.110	-.069855	.007078	.945714
appear~g*	.0038277	.00576	0.66	0.506	-.00746	.015115	.985714
gov	-.0031063	.00187	-1.66	0.097	-.006775	.000563	4.34571
financ~k	-.0018169	.00166	-1.09	0.274	-.005071	.001438	2.36
health_C	-.0023185	.00203	-1.14	0.254	-.006301	.001663	1.4
A_info~n	.0015475	.00126	1.22	0.221	-.000931	.004026	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(2))

Marginal effects after oprobit
      y  = Pr(o_tomatoes==2) (predict, outcome(2))
         =  .13490846
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.0685385	.03375	2.03	0.042	.002391	.134686	.257143
educcat*	-.0150371	.03236	-0.46	0.642	-.078452	.048378	.774286
occup18*	-.096002	.05318	-1.81	0.071	-.20024	.008236	.02
HHmember	-.0021121	.00837	-0.25	0.801	-.018516	.014292	5.26857
number~t	.0133989	.02952	0.45	0.650	-.044454	.071252	1.75143
Eanings*	-.2132076	.06406	-3.33	0.001	-.338762	-.087653	.945714
appear~g*	.0494683	.08197	0.60	0.546	-.1112	.210136	.985714
gov	-.0352037	.0134	-2.63	0.009	-.061467	-.00894	4.34571
financ~k	-.0205917	.01623	-1.27	0.205	-.052407	.011223	2.36
health_C	-.0262761	.0193	-1.36	0.173	-.0641	.011548	1.4
A_info~n	.0175379	.01159	1.51	0.130	-.005171	.040247	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(3))

Marginal effects after oprobit
      y  = Pr(o_tomatoes==3) (predict, outcome(3))
         =  .18630717
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	.0405502	.01788	2.27	0.023	.005511	.07559	.257143
educcat*	-.009843	.02053	-0.48	0.632	-.050072	.030387	.774286
occup18*	-.09499	.07642	-1.24	0.214	-.244773	.054793	.02
HHmember	-.0014269	.00566	-0.25	0.801	-.012519	.009665	5.26857
number~t	.0090522	.01999	0.45	0.651	-.030119	.048224	1.75143
Eanings*	-.0582994	.01586	-3.68	0.000	-.089379	-.02722	.945714
appear~g*	.040301	.07975	0.51	0.613	-.116015	.196617	.985714
gov	-.0237834	.00949	-2.51	0.012	-.042375	-.005192	4.34571
financ~k	-.0139116	.01106	-1.26	0.208	-.03558	.007757	2.36
health_C	-.0177519	.01324	-1.34	0.180	-.043696	.008192	1.4
A_info~n	.0118485	.00796	1.49	0.136	-.003745	.027442	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(4))

Marginal effects after oprobit
      y  = Pr(o_tomatoes==4) (predict, outcome(4))
         =  .66306872
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age13*	-.1248972	.05829	-2.14	0.032	-.239142	-.010652	.257143
educcat*	.0280194	.05973	0.47	0.639	-.089045	.145084	.774286
occup18*	.2048876	.13263	1.54	0.122	-.055072	.464847	.02
HHmember	.0039673	.01572	0.25	0.801	-.026844	.034779	5.26857
number~t	-.025168	.05541	-0.45	0.650	-.133776	.08344	1.75143
Eanings*	.3605256	.09749	3.70	0.000	.16944	.551611	.945714
appear~g*	-.0982301	.17289	-0.57	0.570	-.437083	.240623	.985714
gov	.0661255	.0244	2.71	0.007	.018307	.113944	4.34571
financ~k	.0386787	.03021	1.28	0.200	-.020533	.097891	2.36
health_C	.0493562	.03598	1.37	0.170	-.021168	.11988	1.4
A_info~n	-.0329427	.02156	-1.53	0.126	-.075194	.009309	2.45714

(*) dy/dx is for discrete change of dummy variable from 0 to 1

APPENDIX 3: ESTIMATED OUTPUTS OF DETERMINANTS OF PREFERRED PURHASING OUTLETS/ POINT

Multinomial logistic regression — Number of obs = 350
LR chi2(20) = 66.23
Prob > chi2 = 0.0000
Log likelihood = -315.14035 — Pseudo R2 = 0.0951

prefer_purchase_~_	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
road_side_market	(base outcome)					
super_market						
sex	1.163087	.8844818	1.31	0.189	-.5704654	2.89664
marital_statuscat	1.149217	.388236	2.96	0.003	.3882884	1.910145
educcat	.8594585	.3576342	2.40	0.016	.1585083	1.560409
occup	.2290819	.1033848	2.22	0.027	.0264513	.4317124
HHmember	-.2400855	.0771477	-3.11	0.002	-.3912923	-.0888788
earnings	4.60e-06	2.51e-06	1.83	0.067	-3.27e-07	9.53e-06
appearance_veg	-.3845798	1.12407	-0.34	0.732	-2.587716	1.818556
Distance_market	.0902344	.1280342	0.70	0.481	-.1607079	.3411768
freq_purchase_safe	.3115779	.0879636	3.54	0.000	.1391725	.4839833
knowl_safe_market	-.9184322	.3273581	-2.81	0.005	-1.560042	-.2768222
_cons	-3.225176	1.690289	-1.91	0.056	-6.538082	.0877298
farm_gate						
sex	.2278113	.7945332	0.29	0.774	-1.329445	1.785068
marital_statuscat	.6998716	.4493172	1.56	0.119	-.1807739	1.580517
educcat	.1711391	.3959108	0.43	0.666	-.6048318	.9471101
occup	.2070212	.1252686	1.65	0.098	-.0385009	.4525432
HHmember	-.2517045	.0969181	-2.60	0.009	-.4416605	-.0617485
earnings	7.86e-07	3.62e-06	0.22	0.828	-6.30e-06	7.88e-06
appearance_veg	-.1387166	1.306345	-0.11	0.915	-2.699107	2.421673
Distance_market	.0497604	.160648	0.31	0.757	-.2651039	.3646248
freq_purchase_safe	.420102	.1009207	4.16	0.000	.222301	.6179029
knowl_safe_market	-1.062168	.4201406	-2.53	0.011	-1.885629	-.2387077
_cons	-1.992052	1.87259	-1.06	0.287	-5.662261	1.678156

```
. mfx compute, predict(outcome(1))

Marginal effects after mlogit
      y  = Pr(prefer_purchase_safe_marketroad_==road_side_market) (predict, outcome(1))
         =  .53335422
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
sex*	-.1753772	.14448	-1.21	0.225	-.458556	.107802	.965714
marita~t*	-.2289201	.07061	-3.24	0.001	-.367312	-.090528	.837143
educcat*	-.1450391	.06993	-2.07	0.038	-.282104	-.007974	.774286
occup	-.0551613	.02324	-2.37	0.018	-.100711	-.009611	4.00286
HHmember	.0607309	.01718	3.53	0.000	.027051	.094411	5.26857
earnings	-8.24e-07	.00000	-1.38	0.168	-2.0e-06	3.5e-07	47002.3
appear~g*	.0768262	.25566	0.30	0.764	-.424259	.577912	.985714
Distan~t	-.0190562	.02877	-0.66	0.508	-.075453	.03734	2.79714
freq_p~e	-.0866698	.02003	-4.33	0.000	-.125927	-.047412	1.27429
knowl_..*	.2283192	.06342	3.60	0.000	.104013	.352625	.228571

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx compute, predict(outcome(2))

Marginal effects after mlogit
      y  = Pr(prefer_purchase_safe_marketroad_==super_market) (predict, outcome(2))
         =   .3090498
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
sex*	.1850469	.09944	1.86	0.063	-.009849	.379943	.965714
marita~t*	.1844527	.05519	3.34	0.001	.076288	.292618	.837143
educcat*	.1585499	.05823	2.72	0.006	.044427	.272673	.774286
occup	.0388347	.02047	1.90	0.058	-.001281	.07895	4.00286
HHmember	-.0390081	.01543	-2.53	0.011	-.069256	-.00876	5.26857
earnings	9.44e-07	.00000	1.90	0.058	-3.1e-08	1.9e-06	47002.3
appear~g*	-.0794024	.24038	-0.33	0.741	-.55054	.391735	.985714
Distan~t	.0168449	.02564	0.66	0.511	-.033404	.067094	2.79714
freq_p~e	.0460727	.01693	2.72	0.007	.012885	.07926	1.27429
knowl_..*	-.1402117	.05503	-2.55	0.011	-.248063	-.032361	.228571

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Marginal effects after mlogit

y = Pr(prefer_purchase_safe_marketroad_==farm_gate) (predict, outcome(3))

= .15759598

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
sex*	-.0096697	.10461	-0.09	0.926	-.214694	.195355	.965714
marita~t*	.0444674	.04707	0.94	0.345	-.04779	.136725	.837143
educcat*	-.0135109	.05181	-0.26	0.794	-.115056	.088034	.774286
occup	.0163266	.01538	1.06	0.288	-.01381	.046463	4.00286
HHmember	-.0217228	.01195	-1.82	0.069	-.045139	.001694	5.26857
earnings	-1.20e-07	.00000	-0.27	0.790	-1.0e-06	7.6e-07	47002.3
appear~g*	.0025762	.1522	0.02	0.986	-.295725	.300877	.985714
Distan~t	.0022113	.02	0.11	0.912	-.036987	.041409	2.79714
freq_p~e	.0405971	.0118	3.44	0.001	.017475	.063719	1.27429
knowl_..*	-.0881075	.03918	-2.25	0.025	-.164903	-.011312	.228571

(*) dy/dx is for discrete change of dummy variable from 0 to 1

APPENDIX 4: GARRETT RANKING CONVERSION TABLE

GARRETT RANKING CONVERSION TABLE

The conversion of orders of merits into units of amount of "socres"

Percent	Score	Percent	Score	Percent	Score
0.09	99	22.32	65	83.31	31
0.20	98	23.88	64	84.56	30
0.32	97	25.48	63	85.75	29
0.45	96	27.15	62	86.89	28
0.61	95	28.86	61	87.96	27
0.78	94	30.61	60	88.97	26
0.97	93	32.42	59	89.94	25
1.18	92	34.25	58	90.83	24
1.42	91	36.15	57	91.67	23
1.68	90	38.06	56	92.45	22
1.96	89	40.01	55	93.19	21
2.28	88	41.97	54	93.86	20
2.69	87	43.97	53	94.49	19
3.01	86	45.97	52	95.08	18
3.43	85	47.98	51	95.62	17
3.89	84	50.00	50	96.11	16
4.38	83	52.02	49	96.57	15
4.92	82	54.03	48	96.99	14
5.51	81	56.03	47	97.37	13
6.14	80	58.03	46	97.72	12
6.81	79	59.99	45	98.04	11
7.55	78	61.94	44	98.32	10
8.33	77	63.85	43	98.58	9
9.17	76	65.75	42	98.82	8
10.06	75	67.48	41	99.03	7
11.03	74	69.39	40	99.22	6
12.04	73	71.14	39	99.39	5
13.11	72	72.85	38	99.55	4
14.25	71	74.52	37	99.68	3
15.44	70	76.12	36	99.80	2
16.69	69	77.68	35	99.91	1
18.01	68	79.17	34	100.00	0
19.39	67	80.61	33		
20.93	66	81.99	32		