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The role of consumers' perceptions in the valuation of food safety and convenience attributes of vegetables in Vietnam

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Abstract

Food systems in developing countries are undergoing a profound transformation characterized by the emergence and expansion of modern retailers and integrated supply chains. Appropriate policies are needed to guide this transformation, presupposing a good understanding of consumer preferences. We analyze consumers' valuation of different vegetable attributes in metropolitan areas of Vietnam, using contingent valuation techniques and a mediation framework for two specific examples. Consumers are willing to pay an average price premium of 60% for Chinese mustard that is free of chemical residues and of 19% for different convenience attributes of potatoes. Income levels and media have positive impacts on the willingness to pay, partly mediated through different consumer perceptions like food safety concerns, openness towards new food products or price consciousness. These results deepen our understanding on how consumers value new food attributes.

Keywords: contingent valuation, convenience, food quality, food safety, mediation framework, transformation of food systems, Vietnam

JEL classification: D12, Q13,

1. Introduction

Food systems in many developing countries are experiencing a profound transformation, which is driven by globalization, urbanization, and rising living standards. This transformation is characterized by the emergence and expansion of modern retailers and integrated supply chains within new institutional setups (Reardon et al., 2003). Food quality and food safety are becoming ever more important, which poses new challenges for supply chain actors to adapt to emerging trends on the demand side (Mergenthaler et al., 2009b). Products with a bundle of specific attributes are required that are directed to satisfy consumers' needs (Henson and Reardon, 2005). Understanding consumers' valuation of these attributes is essential for designing effective food policies. While a number of willingness to pay (WTP) and similar valuation studies have been carried out recently (e.g. Florax et al., 2005), most of them focus on industrialized countries. Since the results cannot simply be transferred to developing economies, specific research in developing countries is needed, particularly in metropolitan areas, which usually have a leading role in the food system transformation for the rest of the country (Pingali, 2007).

Given its rapid economic development and recent policy reforms, Vietnam is an interesting developing country to study valuation of food product attributes. Restructuring of food supply chains in Vietnam is observed in the context of ongoing economic liberalization (Maruyama and Trung, 2007). New demand patterns are emerging, entailing a growing importance of food quality and food safety at the retail level (Mergenthaler et al., 2009c). The horticultural sector is affected in particular (Cadilhon et al., 2006), making it an interesting case for a more thorough investigation. Attributes of fresh horticultural products considered in this paper are food safety in terms of low agrochemical residues and different convenience characteristics.

2. Food Quality and Food Safety Attributes

2.1 Food Safety

As a consequence of the intensification process in agriculture (Jansen et al., 1996; Dung et al., 1999), high intakes of agrochemical residues from consumption of food have been reported in Vietnam (e.g. Kurunthachalam et al., 1992). Due to a number of acute poisonings reported in the mid-1990s, use of some highly toxic pesticides was restricted. However, fresh vegetables are still the most important source of food safety risks (Sy et al., 2005). Consumers are particularly worried about chemical residues (Figuíé, 2003).

Already in 1995, the Vietnamese government launched a ‘safe vegetables’ program (*‘rau sach’* or *‘rau an toan’*) to counteract food safety problems in horticultural produce. In this context, the Ministry of Agriculture and Rural Development issued a temporary regulation on the production of ‘safe vegetables’, which adopted maximum residue levels from Codex Alimentarius as a benchmark in 1998. Since then, the government has fostered the development of vegetable production with improved food safety. In cooperation with local authorities, the ‘safe vegetable’ label is promoted in annual fairs for farmers and in advertising programs for retailers and consumers.

Within the program, training and technical support has been given to farmers to improve management of irrigation water, fertilization, and application of pesticides. Produce is marketed through specialized supply chains in a limited number of ‘safe vegetable’ shops and supermarkets. The municipal health care service is meant to work closely with responsible agencies to control regularly the quality and hygienic conditions in vegetable production and marketing. However, after initial external controls and issuance of certificates, quality controls are mostly organized internally in participating cooperatives without external verification, i.e. awarding the ‘safe vegetable’ label is not authenticated by a standardized

certification process, and no formalized sanction mechanisms exist in case of non-compliance (Moustier et al., 2006). Laboratory analyses are hardly conducted or can detect only few types of pesticides (Tam, 2006). The lack of standard enforcement mechanisms involves asymmetric information and distrust between producers and consumers (Hoan et al., 2005). Therefore, potential growth of 'safe vegetables' from the described supply chains are severely hampered (Hoang and Nakayasu, 2006).

2.2 Convenience

While food safety has gained a more prominent role within the food system transformation in Vietnam, convenience in terms of short distances to retail outlets has traditionally been an important aspect for consumers in Vietnam (Cadilhon and Tam, 2004). Later, demand for products with special convenience attributes has also been growing (IFPRI, 2002). Convenience often implies pre-processed products, such as vegetables that are already washed and peeled, in order to reduce the time of meal preparation at home. From the supplier side, processing vegetables into convenience foods is interesting, because this can potentially improve market outreach to different consumer segments, particularly in urban areas (Maruyama and Trung, 2007). Nevertheless, hardly any research has been carried out so far on quantifying related consumer preferences. We hypothesize that especially high-income consumers in Vietnam are willing to pay extra for convenience attributes.

3. Direct Valuation

3.1 Contingent Valuation

In contingent valuation, WTP approaches draw on stated preferences to estimate the value people place on non-market goods. Like analysis based on revealed preferences, WTP analysis is based on utility maximization theory. WTP has traditionally been used for the

valuation of public goods (e.g. environmental services). More recently, it has also been applied in market research for private goods (cf. Lusk and Hudson, 2004). In our context, WTP can be interpreted as an indicator of demand for vegetables with low agrochemical residues or convenience attributes. Apart from assessing market potentials for specific products, WTP analysis can help to better understand general market trends and identify appropriate policy responses.

Our choice of valuation scenarios was based on several criteria. Elicitation of stated preferences is more reliable for objects that respondents are familiar with. Therefore, concrete products and product attributes had to be determined. To value food safety, Chinese mustard was chosen. This leafy vegetable is an integral component of Vietnamese diets. The edible parts of pakchoi are usually exposed to frequent pesticide applications. Furthermore, due to the vegetable's high perishability, supply for the metropolitan areas mainly comes from peri-urban production that is characterized by high input use (Khai et al., 2007). This puts the issue of chemical residues high on the agenda. Against this background, we developed a hypothetical scenario in which – through assumed changes in production technology – there would be no agrochemical residues in the final product.

A second scenario was constructed in which consumers valued convenience attributes of potatoes. Though potatoes are not consumed as widely as leafy vegetables, they are expected to have a bigger potential to be sold with convenience attributes. Respondents were asked for their WTP for fresh potatoes which are washed, peeled, pre-cut, packed, and cooled.

Price premiums were chosen as payment vehicle within a double bounded discrete choice format to elicit consumers' WTP. Based on results of a pre-survey, respondents were first confronted with a random incremental price bid between 15% and 100% above the current market price; for the second bid, the range was 0-200%. In order to make price bids more comprehensible to respondents, they were first asked how much they currently pay for

pakchoi and potatoes, so that the enumerators could translate the percentage price bids into absolute monetary values. For the analysis, absolute increments (the absolute difference between the price bids and the current market price) were used to represent the premium consumers are, or are not, willing to pay for more food safety and convenience. These transformed first and second bids are used in an interval-censored model.

3.2 Data

For the empirical analysis, an interview-based survey of households in Vietnam's two big cities, Hanoi and Ho Chi Minh City (HCMC), was conducted between August and October 2005. In total, 499 households were covered in almost all administrative districts of both cities, including urban and peri-urban areas. The sample is a random sub-sample of the nationally representative Vietnam Living Standard Survey 2002 (VLSS2002) for Hanoi and HCMC. Therefore, the sample also covers households located in the suburbs and villages surrounding the inner city districts. These peri-urban districts are characterized as more rural, so the sample represents a broad picture of different types of consumers. Per capita expenditure levels in peri-urban districts are around 40% lower than those in the urban districts on average.

Selected household characteristics used in the estimation of WTP for the food product attributes are shown in table 1. Average annual per capita household expenditures, which we use as a reliable measure of income, amount to around 9.8 million Vietnamese Dong (VND). This corresponds to US\$ 615 based on official exchange rates, and US\$ 2,960 based on purchasing power parity in 2005. Female labor force participation, often referred to as an important demand-side driver of the food system transformation, is included as a dummy. It takes the value of one if the respondent is female and employed. The educational level of the respondent is measured in years of schooling. Household composition is included with the number of household members and a dummy for the presence of children under the age of

five. Also the age of the respondent is included. Geographic location is captured by two dummies, one for households located in Hanoi (with HCMC as reference), and the other for households located in urban areas (with peri-urban areas as reference).

Apart from these socio-demographic variables, media are hypothesized to influence WTP of consumers. A general impact of media is captured by the number of media regularly used by the respondent, whereby TV, radio, newspaper, and internet were specifically asked for. On average, respondents regularly use two of these media, with TV and newspaper being the most important ones. For a more specific impact of media we distinguish between food safety and convenience valuation. Vietnamese media frequently report about cases of negative health impacts (including lethal effects) caused by spoiled and contaminated food. More than 90% of respondents in our sample indicated that they have heard or seen such reports in different media, particularly on TV. This possible impact on WTP is captured by a dummy in the safety valuation. In the convenience model, a different dummy is included that captures whether respondents have heard or seen advertisements for processed horticultural products in the different media.

Consumer perceptions are expected to impact on food safety and convenience valuation as well. For safety valuation, knowledge about pesticide use, food safety concerns, trust in the 'safe vegetable' label, and price consciousness are considered. In the case of convenience, we test openness towards new food products, preferred food shopping time in the evening, and price consciousness. All these perception variables are represented as dummies, as shown in table 1. In addition to media, socio-demographic and perception variables, we additionally control for scenario variation, previous purchase experience of similar products, the first price bid, and the price of the respective conventional product.

3.3 Direct Impacts on WTP

The direct impacts of the socio-demographic and media variables on WTP are displayed in table 2 in the left column.¹ Per capita household expenditure is a highly significant determinant of the value consumers attach to food safety and convenience. Each additional million VND of expenditure increases WTP by 62 and 74 VND/kg for the two attributes, respectively. For convenience, age and residence in Hanoi have significantly negative impacts on WTP. Surprisingly, also female labor force participation reduces WTP for convenience. An explanation could be that with the additional income generated and an increase in the opportunity cost of time, meal preparation would rather be delegated to older generation family members than used to buy convenience products; this is a typical arrangement of intra-household labor sharing in Vietnamese cities. Urban residence positively influences WTP for food safety, probably reflecting a lack of market transparency. The other socio-demographic variables are not significant in these model specifications.

Interesting to observe is the impact of general media use on WTP for food safety but not on convenience. The specific media variable is not significant in both cases: evidently, having heard or seen information specifically related to the attributes valued does not impact on WTP. Yet, this variable and also some socio-demographic predictors might be associated with indirect effects, which have not been addressed in our paper yet. Nor are the mechanisms through which the socio-demographic and media variables impact on WTP clear yet. These aspects are analyzed in the following.

¹ Estimated coefficients of the controlling variables are not presented and discussed here but are included in an extensive version of this paper in Mergenthaler et al. (2009a).

4. Indirect and Mediated Valuation

4.1 Mediation Framework

We adapt a mediation framework, which was first developed within psychological research (Baron and Kenny, 1986) and recently applied in an analysis of consumer attitudes towards agrobiotechnology (Moon and Balasubramanian, 2004) to analyze the role consumer perception play in the valuation process. In this framework, we consider consumer perceptions as potential mediators between socio-demographic and media predictor variables and the value consumers attach to improved food safety or convenience attributes. Whereas predictors (socio-demographics and media) are external influences that determine the content and way of information processing by the individual, mediators are the result of this information processing. We hypothesize that there is a causal flow from socio-demographic consumer characteristics and media (predictor variables) to consumer perceptions (mediators) and/or to valuation of food attributes (dependent variable), as shown in figure 1. The question we address is whether the predictor variables affect consumer perceptions and food attribute valuation individually or combined. For example, consumers in households with more media use might be more knowledgeable and more concerned about pesticides, and in this way they might value food safety higher. Similarly, older consumers might be less open towards new food products, and in this way they might value convenience attributes less. The main advantage of the mediation framework is that it can detect indirect and mediated effects, which would go unrecognized in a conventional valuation study. We use the Sobel test to identify mediation, which is a direct and statistically rigorous method to test mediation hypotheses through assessing the strength of the indirect effect.

4.2 Indirect and Mediated Impacts on WTP

Summary results of the magnitude and significance of indirect and mediated effects based on the Sobel test are presented in table 1. For food safety valuation, our model indicates that the effects of socio-demographic variables are not mediated through consumer perceptions, although indirect effects occur for education and residence in Hanoi. For both variables, the indirect effect is through knowledge. Residents of Hanoi are less likely to know about pesticide use in vegetables, which indirectly reduces their WTP for products that are free of agrochemical residues. Better education, in turn, increases knowledge levels and thus also WTP for food safety. The indirect effects of media are also interesting. Consumers who use more media channels on a regular basis are more concerned and less price conscious, thus influencing WTP for food safety positively. Having heard or seen specific media reports increases knowledge, thereby also increasing WTP for residue-free products. Even though having heard or seen media reports about food safety issues undermines trust in the 'safe vegetable' label, a significant indirect effect on WTP through the trust variable cannot be established.

For the valuation of convenience, more mediated and indirect effects can be observed. The effect of household expenditure levels on WTP for convenience is positively mediated through higher levels of openness and lower levels of price consciousness. Opposite effects are detected for consumers in Hanoi. Residence in urban districts impacts positively and age negatively on WTP for convenience, in both cases through different levels of openness. Household size has a positive indirect impact through openness, which however is counteracted by a negative indirect effect through price consciousness. The media variables also have different indirect effects on WTP for convenience attributes. General media use positively impacts on WTP through higher levels of openness and lower levels of price consciousness. On the other hand, having heard or seen food advertisements has a negative

impact through less openness. The latter effect is somewhat unexpected. A possible explanation is that these advertisements are not appealing to consumers and cause them to be less open towards new food products in general.

5. Mean WTP

Based on our regression models, we estimate the mean WTP for the food safety attribute to be 60% and for convenience to be 19% higher than the current market price of the respective vegetables. In the Vietnamese context, it is not surprising that WTP for food safety is higher than for convenience, because average income levels are still relatively low, but awareness of food safety issues is widespread.

How do our estimated values for mean WTP compare with previous results from other studies and countries? In rich countries, mean WTP for products that are free of agrochemical residues is often somewhat lower than what we found here, when comparisons are made in percentage terms relative to the market price of conventional products (cf. Florax et al., 2005). This should not surprise, however, because food regulations in poor countries are usually less strict or less strictly enforced, so that the chemicals used are often more toxic and residue levels much higher. The few results that are available for other low and middle income countries are more similar to ours. For instance, Fu, Liu, and Hammitt (1999) found price increments between 46% and 75% for a leafy vegetable with low pesticide residues in Taiwan. Schmidt and Vanit-Anunchai (2004) estimated mean WTP to be almost 100% for ‘environmentally friendly’ produced Chinese cabbage in Thailand, while Krishna and Qaim (2008) found a WTP for residue-free vegetables of 57% in India. Our results suggest that the range of customers for residue-free vegetables could increase considerably at somewhat lower prices. We are not aware of any previous studies that have estimated WTP for convenience attributes in a developing country context.

6. Conclusions

Food systems in many developing countries are currently undergoing a profound transformation, with food quality and food safety aspects growing in importance. Against this background, we found that in terms of food safety, Vietnamese consumers on average are willing to pay 60% more for vegetables that are free of agrochemical residues. In terms of convenience, we have analyzed potential demand for vegetables that are pre-processed so to reduce preparation times within the household, and found a mean WTP of 19%. WTP for both attributes is positively related to household expenditure levels, so that further income growth will fuel demand for safe and convenient food products.

Particular emphasis has been put on the potential role of consumer perceptions as mediators of the effects of socio-demographics and media. It was found, for instance, that education of survey respondents, as well as location variables, can lead to indirect effects on WTP for food safety and convenience. In addition, the influence of public media on WTP is mediated or partly channeled indirectly through consumer perceptions. A more widespread and regular use of different media channels is likely to increase consumer demand for new product attributes. While consumer concerns have a large impact on the valuation of food safety, WTP for convenience attributes is mostly channeled through perceptions such as price consciousness and openness. From a policy perspective, public media can and should be used to promote the spread of objective information, especially with respect to health issues.

What are the implications for the food sector as a whole? Supply chains should be ready to respond to the increasing demand for food safety and convenience attributes. Relatively high WTP for new attributes indicates that there is a lot of potential for value added – value that could positively contribute to economic and social development, if captured domestically and shared equitably. This is a challenge for public policy.

Convenience characteristics are mostly search attributes, so that markets for convenience products will develop automatically, when living standards rise. For food safety this is different, since safety characteristics are credence attributes, which easily lead to market failures. Direct public intervention will be necessary in terms of establishing credible standards and certification systems.

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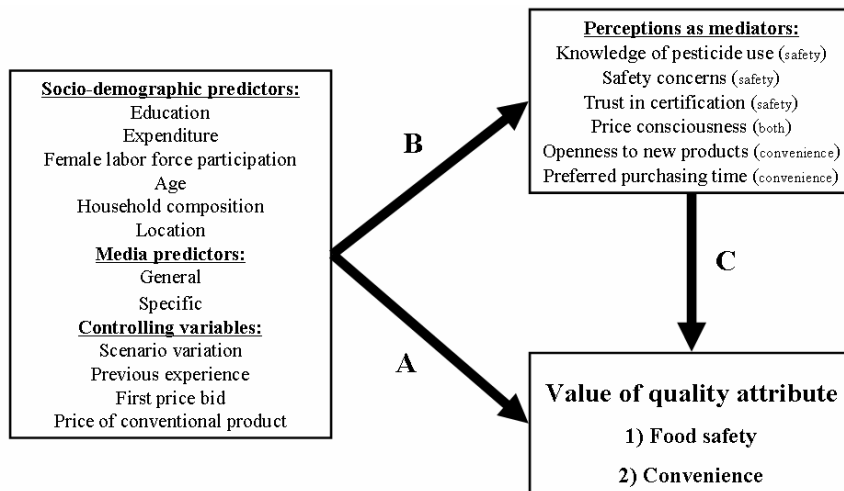


Figure 1: Valuation of food safety and convenience in a mediation framework

(adapted from Baron and Kenny (1986)).

Table 1: Sample means of socio-demographics' and their direct and indirect impacts on WTP

	Sample means	Safety					Convenience			
		Direct effects	Indirect effects through				Direct effects	Indirect effects through		
			Knowledge	Concerns	Trust	Price		Openness	Time	Price
Share of consumers with respective perception			0.76	0.93	0.33	0.38		0.20	0.04	0.38
Media predictors										
Number of media regularly used	2.00 [0.82]	270.29* [141.47]	-19.93 [18.15]	27.07* [16.34]	1.63 [9.04]	59.66* [30.98]	211.10 [227.24]	194.71*** [66.39]	0.94 [11.73]	152.42** [59.77]
Heard or seen specific reports in media (dummy)	0.90 -	-338.24 [367.28]	130.7* [76.23]	25.91 [31.93]	31.78 [47.08]	0.00 [42.48]				
Heard or seen advertisements in media (dummy)	0.80 -						-48.11 [446.51]	-265.55* [141.91]	-2.50 [24.03]	-61.39 [76.72]
Socio-demographic predictors										
Education (years of schooling)	8.68 [4.48]	-29.54 [32.51]	19.05** [8.78]	3.48 [2.52]	-2.95 [4.15]	-0.55 [3.73]	46.11 [48.59]	-14.09 [11.48]	-1.02 [2.78]	-0.37 [8.76]
Annual per capita expenditures (million VND)	9.76 [6.43]	61.97*** [21.72]	1.70 [2.23]	2.32 [2.06]	0.35 [1.06]	4.01 [2.76]	74.02*** [27.84]	21.92*** [7.32]	0.63 [1.36]	10.00* [5.82]
Purchase person is female and employed (dummy)	0.22 -	-342.37 [278.16]	-40.42 [39.47]	8.89 [13.65]	25.18 [34.64]	-44.07 [37.67]	-754.66* [433.03]	154.99 [107.10]	32.78 [52.57]	-105.6 [82.23]
Age of respondent (years)	50.38 [13.37]	-4.29 [8.90]	0.13 [1.02]	-0.58 [0.61]	1.39 [1.82]	0.45 [1.06]	-27.39* [14.12]	-8.61** [3.75]	-0.23 [0.80]	0.99 [2.46]
Household size (heads)	4.77 [7.21]	3.03 [57.89]	6.98 [6.91]	-4.06 [3.50]	-1.68 [3.96]	-12.74 [8.41]	75.32 [86.72]	34.83* [20.04]	-1.96 [5.52]	-30.88* [17.49]
Household with children under 5 (dummy)	0.23 -	[239.96]	[12.20]	28.62 [18.50]	3.88 [17.15]	52.29 [37.18]	-33.63 [420.65]	-71.43 [93.25]	-7.9 [22.68]	129.69 [78.91]
Households located in urban districts (dummy)	0.73 -	508.91* [288.55]	-26.84 [29.96]	5.61 [15.54]	-4.19 [18.61]	4.11 [31.96]	671.10 [460.68]	272.79*** [104.01]	-17.05 [35.55]	9.88 [75.13]
Households located in Hanoi (dummy)	0.37 -	260.05 [261.47]	-117.5** [57.31]	-3.29 [13.32]	63.72 [80.23]	-49.49 [35.47]	-1,484.27*** [401.23]	-163.79* [90.82]	13.14 [27.00]	-134.75* [78.75]

Notes: Coefficients are marginal effects on WTP (measured in VND/kg), evaluated at sample means. Standard deviations for means and standard errors of marginal effects are shown in brackets. Results are based on 499 observations.

*, **, *** Significant at the 10%, 5%; and 1% level, respectively, based on the Sobel test.