Valuation of Safety-Branded and Traceable Free Range Chicken in Ha Noi: Results from a Field Experiment

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Abstract

The valuation of traceable or safety-branded food by consumers in developing countries affected by diseases such as avian influenza, or with food safety issues in general, is very difficult to identify. Products that have safety-branding are not common, and food is usually purchased by bargaining at informal markets. However, valuation of traceability has important implications for livestock disease policies as well as agricultural sector development. Through developing a short-term certified supply chain for free range chicken in Hanoi, we were able to conduct a combined field experiment and detailed household survey to measure the valuation of this type of poultry. We find that consumers in urban Hanoi on average have a welfare gain of about $1 per whole chicken purchase for safety-branding and traceability, which translates into a potential annual consumer welfare gain of $66 million for such characteristics.

Keywords: field experiments, avian influenza, Vietnam, food safety

JEL classification: C93, D12, Q13, Q18

The food preferences of urban consumers in rapidly growing countries like Viet Nam will have a large impact of the development of the agricultural sector in these countries (Pingali, 2007). How demand for food evolves will have important implications for policies related to food safety, agricultural development and rural poverty. Demand for safe food is especially relevant in Viet Nam, where highly pathogenic avian influenza (HPAI) has become endemic after several large outbreaks from 2003-5 (Rushton et al., 2005). Chickens markets in urban areas have drastically changed, but demand for chicken remains differentiated based on breed as opposed to safety-related characteristics. Specially, consumers in Ha Noi still prefer free-range chicken, and have largely not shifted to frozen chicken cuts that are safety-branded and sold in supermarkets. For chicken purchased at home, about 90 to 95 percent is purchased from informal sources, largely wet or open air markets (Ifft et al., 2008a).

Chicken has an important cultural role in Vietnam, with most families eating chicken during the New Year (Tet) and certain lunar holidays. Awareness of how different breeds of chicken are raised is high amongst urban households, with consumers correctly linking breed and production environment to desired meat quality characteristics(Ifft et al., 2008a). The vast majority of households overall prefer to consume fresh food that is purchased daily in small markets near their home (Maruyama and Trung, 2007). Very few studies, if any, to estimate chicken demand or demand for poultry safety have been undertaken in Viet Nam, although avian influenza outbreaks have led to increased

interest in the development of the poultry sector in Vietnam. Of existing studies related to chicken consumption, data collected has not been used for formal demand analysis (Figuié, 2007; Phan and Reardon, 2007).

Demand for safety-branded free range chicken in urban areas of Viet Nam has a critical policy importance. The production characteristics of free range chicken are different from those of confined (translated as 'industrial') chicken, both presenting unique food safety and animal disease risks. Free range chicken is more likely to be exposed to wild birds, while industrial chicken production present risks inherent to concentrated production (Otte et al., 2008). These types of chicken are also produced on different types of farms and marketed through different supply chains (Ifft et al., 2008b), necessitating differentiated policies. Given the widespread popularity and large premium (up to 100%) for free range chicken, market-based policies are a promising mechanism to decrease epidemic risk. The valuation that consumers place on safety-branding will determine the effectiveness of market-based policies such as third-party certification of poultry. If traceability and safe production practices benefits could be effectively marketed, such characteristics move from being an additional cost to providing tangible benefits for producers, consumers, government, and society in general (Ifft et al., 2008a). Traceability has benefits of identification of the source of disease or low quality, assigning liability, and allowing consumers to verify quality (Hobbs, 2004). This paper will focus on identifying the valuation of safety-branding of free range poultry in Ha Noi, the capital of Viet Nam. These measures can be used to determine the feasibility and potential welfare gains from credible safety-branding and traceability.

Most food demand studies for developing countries utilize household surveys (such as LSMS surveys) and use broad categories of food types, such as beef, poultry and pork (for example, Mdafri and Brorsen (1993); Jabarin (2005)). Studies that focus on demand for specific quality attributes, credence goods, safety, etc. are more likely to be undertaken in developed countries. Existing data on consumption of differentiated products is especially limited in developing countries, and this holds in Viet Nam. Valuation of safety-branded free range chicken, or differentiated chicken breeds in general, requires original data.

Well-defined stated preference methods can be important research tools, but are ultimately limited in that they do not necessarily reflect actual behavior or preferences. List and Gallet (2001) estimated that hypothetical valuation exercises lead to participants overstating their preferences by a factor of

3. Data collected from actual behavior or consumption choices is ideal, but often economists want to measure preferences related to goods or services that are not actually sold. Price data can be especially problematic, as it contains information about unobserved quality. Further, data on actual consumption choices does not always allow economists to control for the context under which those choices are made. In this respect, methodologies for undertaking field experiments are especially useful in allowing for inference from otherwise limited data.

Economic experiments to value food safety and quality characteristics have been implemented in several wealthier countries. Lusk et al. (2006)use an experimental auction to determine valuation of genetically modified foods in the United States and Europe. Noussair, Robin, and Ruffieux (2002) use an experiment to determine if consumers value genetically modified organism food labels or lack information. Lusk, Norwood, and Pruitt (2006) use coupon-based experiment to determine valuation of antibiotic-free pork. Loureiro, McCluskey, and Mittelhammer (2003) use an economic experiment to determine valuation of eco-label apples. Dickinson and Bailey (2002) use a laboratory experiment to value several meat characteristics, including traceability. A few studies have successfully used experiments to value food characteristics in developing countries – Masters and Sanogo (2002) find that the economic surplus from certification of nutrient density in infant foods in Malawi is over $1 million annually. For our field experiment design, we used aspects of previous experiments adopted to the circumstances in Ha Noi poultry markets.

Field Experiment Design

Economic experiments offer a method for economists to observe actual choices made by households, and to also control the conditions under which those choices are made(List, 2009). In this context, an economic experiment was ideal for measuring consumer valuation of traceable free range chicken that had a safety brand. We choose to implement an economic experiment that is closer to a field experiment than lab experiment in design, which can be distinguished on several factors related to the context in which individuals would actually make the decision being studied. Harrison and List (2004) define several important areas of distinction, including subject pool and the commodity that is involved. Our approach involves the actual subject pool and commodity that we are interested in. Our participants further make a choice that has a non-hypothetical impact on their expenditure

for the commodity of interest.

This field experiment was undertaken in conjunction a FAO-implemented pilot project for certified supply chain for smallholder[1] chicken in Hanoi (Ifft et al., 2009). Chicken from the project, henceforth 'project chicken', was sourced from small farms in a large rural district of Hanoi municipality. Two major types of free range chickens are raised in Viet Nam, which are directly translated as 'local chicken' and 'crossbred chicken'. Local chicken is refers to native breeds raised on a scavenging diet, while crossbred chicken are native and exotic crosses allow to scavenge in garden or confined grazing area with occasional purchased feed. All project chickens were crossbred chickens, as sourcing from local chicken farms would have been too expensive given the dispersion and small number produced at each farm.

Each project farm was required to have vaccination for HPAI and other common poultry diseases and follow specific guidelines for safe production practices. These farms were closely monitored by local veterinary officials, which were under the supervision of the district veterinary office. Farms were also randomly visited by an external veterinary inspector as an additional safeguard. Within a week of slaughter, a small but distinguishable tag was put on the foot of each chicken by local veterinarians. The tag was designed so that if it was removed it could not be reused.

Through coordination with traders, the project chicken was delivered to registered[2] slaughterhouses at a small wholesale market. The slaughterhouses then distributed the chicken to 8 vendors in 4 markets that were already a part of their distribution network. The vendors were supported with training on chicken characteristics and advertising materials. The chicken was distinguishable to consumers by the tag, and also was packaged after sale in a special bag. Vendors were responsible for recording information on all chicken sales before, during and after the testing marketing period.

Through discussions with the market vendors, the "catchment area" for each market was defined. From this area, blocks were randomly selected and all households in those blocks were listed. Systematic sampling was used to select households within each market area, for a sample of households that would be representative of all households that might regularly visit each market where project chicken was being sold. Out of 1200 selected households, 923 households in total took the household survey and participated in the experiment. All selected households were visited by enumerators to

[1] Free range chicken is largely produced by smallholders, who do not have sufficient resources to produce industrial chicken

[2] Very few slaughterhouses in northern Viet Nam achieve registration, or government certification

take a detailed survey about poultry consumption and attitudes that took about 20-25 minutes. The enumerators requested to interview the person with primary responsibility for food purchases for each household visited.

After the survey, each survey respondent was offered a choice of 1 of 2 discounts for 2 types of chicken as a gift for taking the survey. Each set of 2 discounts was randomly assigned to each household, with alternative 1 being project chicken and alternative 2 either regular crossbred or local chicken. Whether the alternative was local or crossbred was also randomly assigned, and both alternatives were to be purchased from the same vendor. After selection of a discount, the participant was given a coupon that was redeemable from one of the project vendors. The household was told the weekly market price of each type of chicken and was given a brochure explaining project chicken before they make their choice. This would be similar to the market, where information was available on the project chicken, but other chicken has no advertising or marketing.

Several different designs were considered for this experiment. The decision to conduct the experiment through a household survey at the home instead of in the market was based on shopping habits. Women conduct most of the food shopping in Ha Noi, and usually make daily trips to markets purchase food. As several women work, the markets tend to be very crowded and busy for short periods of the day. Outside of the busy periods, the number of customers is much less. Recruiting survey participants in the market would have been difficult due to periodic crowding, and would have also led to a much less representative sample. Enumerators visiting households could visit at times which were convenient for the participants.

Auctions are a common method for experiments (for example, Lusk et al. (2006)), but the household survey format of this experiment made such an approach too time-consuming. The household survey format had the advantage of having detailed background information on chicken consumption, as well as allowing for testing of the impact of household characteristics on demand for traceability. To adjust for having only one choice set per participant, we increased the sample size to allow for more decisions to be analyzed.

We also considered offering participants the choice of a third option, such as cash or a general discount on food. Due to safety and accountability issues, we choose not have enumerators carry cash with them while implementing the survey. Having households make a series of choices is also common in experiment or stated preference exercises (for example, Masters and Sanogo (2002)).

This would involve giving the participant a choice between 2 discounts and having them select 1, and repeating the exercise several times. The actual discount would be randomly drawn from the selected discounts. Although such an approach allows for potentially greater inference, explaining this procedure and conducting the series of choices would have taken a large amount of time to the survey and experiment, likely decreasing participation.

The choice of presenting the coupon as a discount from total chicken purchase, a per kg discount, or a low(er) price for a chicken purchase was based on the local circumstances. For the certified supply chain project, the vendors were required to record all prices for all chicken sold, including project chicken. Recording of individual prices and sales was unfamiliar for most vendors, so having a discount coupon that was easy to use was very important. We also had to ensure that vendors would have no incentive to misreport prices or quantities, as was the case with the options of a per kg discount or a discounted total price. Due to bargaining, prices are always somewhat flexible in Viet Nam, and vendors could not be persuaded to make a special case for customers with a discount coupon. When presenting the choice to survey participants, they were told the discount for each alternative, and the weekly market price for that type of chicken. Due to this uncertainty with bargaining, we will use the customer's choice of discount during the experiment to undertake our analysis.

Branding and traceability could be considered different traits: branding has an affect related to the credibility or reputation of the firm selling a product, while traceability is a specific safety-related characteristic. In this article we are analyzing valuation of both safety-branding and traceability. In a laboratory experiment, it might be possible to distinguish between valuation of these 2 characteristics, although safety-branding would always be unique to a specific firm. In practice traceability cannot be separate from safety-branding, as traceability must be backed by credible source. The information provided during the experiment and separately when test marketing the project chicken provided a detailed description of the project activities and objectives. The organizations involved had to listed on all materials, but emphasis (font size, content, etc.) was placed on the actual activities and safeguards put into place. The actual traceability and safety guarantee was related to a promise of safe production, trading and processing practices and the ability to trace chicken to the original farm where the chicken were tagged. Although the tag was a unique innovation to ensure traceability, consumers would still have to some trust in the sponsoring institutions and key project

participants, which was achieved through the safety branding. We interchangeably use traceability and safety-branding in this document, given their inherent inseparability in the market context.

Theoretical Framework

By conducting a field experiment, we are able to control the characteristics of goods that are offered to consumers, and have them make a decision that has a real impact on consumption. Lancaster (1966)defines goods as a set of characteristics, in which utility is a function of characteristics, not goods. From this framework, utility from a good can be defined as $U_i = f(z)$, where z is a set of characteristics of that good. Other than the chicken characteristics defined in our experiment, which were price, 'project chicken', and breed, no other differences in characteristics could be discerned by the participant.

The choice of alternative of each household can be represented by a random utility model. We can assume that consumer's utility is a function of observed characteristics and unobserved stochastic variation across individuals. Observed characteristics (z) are the price of chicken (p), safety of chicken (t), and the variety (v) of chicken. Unobserved variation in utility is denoted as ε, and can be assumed to be distributed extreme value. Because variation in prices, safety, and variety were randomly assigned, we know that error term or unobserved variation in utility is not correlated with our observed characteristics, or $\mathbb{E}(\varepsilon_i z_i) = 0$ for observed characterstics. All variables are exogenous by design, so our model with not be impacted by endogeneity problems persistent in market data.

In our experiment, we have chicken that is either traceable (project chicken) or non-traceable , as well as chicken that is either crossbred variety or local variety. If utility is linear and additive, it can be expressed as follows: $U_i = \beta_1 p_i + \beta_2 t_i + \beta_3 v_i + \varepsilon_i$. Household characteristics (h) can also be added our utility function by interactions with our variables of interest. We are most interested in WTA traceability, so we will interact h with t for the following specification: $U_i = \beta_1 p_i + \beta_2 t_i + \beta_3 v_i + \beta_4 (t_i h_i) + \varepsilon_i$.

From this framework we can use a logit model to estimate the β coefficients and willingness to pay for safety-branding and variety (Train, 2003). If a participant has 2 choices, she will pick option 1 if $\beta_1 p_1 + \beta_2 s_1 + \beta_3 v_1 + \varepsilon_1 > \beta_1 p_2 + \beta_2 s_2 + \beta_3 v_2 + \varepsilon_2$, or $\varepsilon_1 - \varepsilon_2 > \beta_1 p_2 + \beta_2 s_2 + \beta_3 v_2 - \beta_1 p_1 - \beta_2 s_1 - \beta_3 v_1$. The difference in errors has a logistic distribution, which is a well-established property of these models.

We then know that the probability of picking alternative 1, P_{n1}, is $\frac{\exp(\beta z_{n1})}{(\exp(\beta z_{n1})+\exp(\beta z_{n2}))}$, where β is a vector of the β coefficients, and z is a vector of alternative characteristics.

Many of the disadvantages of a logit are related to independence of irrelevant alternatives (IIA) and issues with panel data. Given that we only had two alternatives and 1 choice situation, these concerns are not relevant. Mixed logit would allow for estimation of taste variation across individuals, but our data does not have enough alternatives or individual choice situations for a mixed logit. Logit analysis hence is a reasonable approximation for average tastes (Train, 2003).

From logit estimation we can easily estimate willingness to accept (WTA), or equivalent variation (EV), for specific characteristics. We use the interpretation of WTA over willingness to pay (WTP) because households were given a coupon, and the choice to give up one coupon over the other would indicate willingness to accept certain characteristics over others. Equivalent variation is the amount of utility that an individual would give keep a certain characteristic (or price). For logit models, WTA (or WTP) can be directly estimated from our coefficients: WTA for characteristic i would be $\frac{\beta_i}{\beta_p}$, where β_p is the price coefficient (Louviere, Hensher, and Swait, 2000).

Our price variable can be expressed as actual discount, price per kg less the discount, or price per chicken less the discount. The most appropriate measure is the one that that best represents the actual measure participants used to make their decision. If we use discount, the interpretation of WTA will be willingness to accept a decrease in discount for a specific characteristic, which would be additional to any existing price differential. The 3rd measure will have a straightforward interpretation, while the second will not, as a whole chicken is usually heavier than 1 kg. This issue will be further discussed in the results section.

Results and Conclusions

The choices that survey participants made based on discounts is summarized in table 1. In table 1, we can see that households selected project chicken 91% of the time when the alternative was crossbred, and 65% of households selected project chicken when the alternative was local chicken when the same discount was offered for each alternative. Likewise, when the discount for project chicken was 2,500 Vietnamese Dong (VND) larger than crossbred chicken, 96% of household selected project chicken, while 85% of households selected project chicken when the alternative was local.

Table 1: **Percent of Households Selecting Project Chicken over Alternatives**

	Crossbred Alternative		Local Alternative	
Difference in Discount	Percent	Obs.	Percent	Obs.
<-2,500 VND	57%	112	28%	98
-2,500 VND	70%	77	39%	66
Same Discount	91%	89	65%	83
2,500 VND	94%	84	71%	62
>2,500 VND	96%	129	85%	87
Total	82%	491	57%	396

Table 2: **Conditional Logit Model Results**

	Discount	Price per Kg	Effective Price
	(1)	(2)	(3)
Discount	-3.473***		
	(.317)		
Price per Kg less Discount		-.678***	
		(.133)	
Effective Price			-.355***
			(.097)
Local Breed	1.293***	2.055***	1.819***
	(.173)	(.236)	(.237)
Traceability	1.757***	1.812***	1.723***
	(.138)	(.136)	(.135)
Obs.	1774	1774	1774
Log-Likelihood	-428.321	-492.77	-499.875

***significant at 1% level, **5% level, *10% level

2,500 VND is about $US 0.25. We can see that households responded to increasing levels of discount, but that the local chicken alternative was considered more valuable that the crossbred alternative.

Results of our estimation using a conditional logit can be found in table 2. Although we do not estimate the coefficients, we observe that all coefficients have a statistically significant effect at the 1% level on the choice between alternatives. Traceability appears to have a consistent effect across specifications, while local breed has more fluctuations. In table 3, WTA for both traceability and local is calculated across different specifications.

WTA traceability is much higher with effective price or price per kg than with discount as the price variable. This is true even when we add the existing price differential to the WTA a discount for traceability. Participants appear to have made their decisions largely by considering the discount, instead of considering effective prices, even though this information was given to them. Local chicken is much more valuable than crossbred chicken, and the willingness to accept $0.37 as a lost discount for local chicken indicates valuation of local chicken that is higher than the actual price differential

Table 3: **Willingness to Accept Chicken Characteristics**

	WTA Traceability	WTA Local Breed
Discount	$US 0.51	$US 0.37
Unit Price Less Discount	$US 2.67	$US 3.03
Effective Price	$US 4.91	$US 3.94

with crossbred chicken. As long as prices do not reflect the full welfare gain from local chicken, a higher WTA would be expected.

Using the price variable that best fits true behavior is most appropriate in this case. We can see that the discount had the greater weight in household's decisions by disaggregating our sample between households that were offered crossbred as an alternative, and households that were offered local chicken as an alternative. When we analyze the subset of households offered local chicken, we must interpret the WTA the alternative as the WTA a discount for traceability over a discount for local chicken.

The results of calculating WTA from logit estimation on these 2 subsets can be found in table 4. When considering crossbred chicken, our WTA measure for traceability when we use discount is almost the same as when we consider the entire sample. The WTA traceability for unit price less discount and effective price reflects the actual price differential plus discount. For the subset faced with the local chicken alternative, we see that WTA a discount for traceability over a discount for a local breed is $0.14. When we calculate with unit price less discount as our price variable, our coefficient for traceability is not statistically significant, hence we do not have an accurate measure for WTA. For the effective price, our price coefficient is only statistically significant at the 15% level, so we must interpret this measure with caution. The WTA of $2.27 indicates households willing to accept $2.27 for a project chicken purchase over a local chicken purchase, which is a little larger than the existing price differential between crossbred and local chicken. This type of measurement of price gives unstable estimates of WTA traceability due to large price differential between local and crossbred chicken. In this case, mental accounting of the price differential and discount might have been more complicated than with just crossbred chicken.

Given that the coefficient on traceability is stable when we use discount as our price variable and estimate with the entire sample or the subset that had crossbred chicken as an alternative, we will use the measure of WTA a discount for traceability to determine valuation of traceable chicken. Given that the price differential for a whole bird (as observed in the market and reported to experiment

Table 4: **Disaggregated Willingness to Accept Traceability**

	WTA: Cross Alt.	WTA: Local Alt.
Discount	$US 0.47	$US 0.14
Unit Price Less Discount	$1.06	$US 0.14*
Effective Price	$US 1.29	$US 2.27**

$^{\star}\beta_2$ coefficient not statistically significantly below 0.15 level
$^{\star\star}\beta_1$ coefficient statistically significant above 0.15 level

Table 5: **Impact of Household Characteristics**

Description of Variable	Mean	Coefficient
Concern for chicken flavor (scale of 1-10)	7.2	-0.003
Concern for chicken origin (scale of 1-10)	7.4	-0.098*
Concern for avian flu (scale of 1-10)	8.3	0.064****
Previous purchase of private-branded chicken	0.58	-0.083
Weekly chicken consumption, kg	0.83	-0.174
Age of survey participant	47	-0.006
Participant is employed	0.63	-0.073
Participant recently exposed to HPAI information	0.67	0.103
Participant incorrectly answered basic HPAI questions	0.23	-0.176
Participant had previously heard of project chicken	0.07	-0.113
Participant regularly shops at project chicken market	0.55	0.227****
Concern for brand purchases (Scale of 1-10, summed for 5 products)	29.57	-0.044***
Education level of household adults (1-5: 1=primary, 5=university)	3.3	0.310**
Enumerator appraisal of wealth level (Scale of 1-5)	2.8	0.036
Trust in Market Inspector (Scale of 1-10)	5.28	-0.193***
Weekly per capita food expenditure, $US	17.60	0.0004

***significant at 1% level, **5% level, *10% level, ****20% level

participants) between regular crossbred chicken and crossbred chicken with traceability is about $0.50, we add that differential to the WTA traceability, which indicates a valuation of traceability of about $1 per chicken purchase. Even if our participants were placing more weight on the discount when they made their choice, the stability of the WTA traceability across estimates indicates that participants were aware of the existing price differential.

In addition to measuring the valuation of traceability and safety branding, we are also interested in the impact of household characteristics on preferences for traceability. We measure this by adding various household characteristics to our utility function that are interacted with the traceability indicator variable. These variables were individually added to the conditional logit specification the discount as the price variable, with results in table 2. The results and a description of the tested variables can be found in table a. The left column describes each variable, the middle column is the mean of each variable, and the right column gives the coefficient (β_4) from the logit estimation.

Our results for the impact of household characteristics on demand for traceability can be found in table 5. The overall impact of household characteristics appears to be small, most variables have an impact is of small magnitude, or is not statistically significant. Not all of the results are intuitive, but might have several explanations. Concern for avian flu has a small positive impact, while concern for origin has a negative sign. This might indicate that valuation of traceability is relate to concerns other than a desire to know exactly what farm a chicken came from. Households that regularly shopped at markets where project chicken were being sold appears to put a higher value on traceability, but the effect is very weak. One potential interpretation is that households are more likely to trust brands or guarantees from vendors that they trust. Concern for brand purchases has a negative and significant coefficient, but might just indicate that preference for brand purchases in other areas is not related to chicken. Concern (or preference) for brand purchases was asked for 5 categories: cosmetics, appliances, liquor, clothes, and vegetables. Estimated individually, concern for brand appliances has a significant and positive coefficient, but all other categories are not statistically significant.

Households with a higher level of trust in their local market inspector were less likely to value traceability, which implies that adequate trust in local institutions decreases demand for traceability or safety-branding. Households were asked for their level of trust in varies entities, also including companies, the Department of Animal Health, and their local market vendors. Local market inspectors had the lowest score, while international companies and local market vendors were the most trusted entities. The result that education increases valuation of traceability is also expected. Educated households might have more knowledge of risks, or might have more interest in purchasing branded items, as well as a larger income.

Through temporarily creating a supply chain for the chicken characteristics that we wanted to value, we were able to conduct a field experiment that addresses many of the issues with valuing food characteristics in developing country settings. We find that households living in urban Ha Noi are willing to pay approximately $1 per free range chicken purchase for traceability that is backed by safety branding. Through our household survey, we determined that average weekly consumption of free range chicken is about 0.8 kg per week, and a free range chicken weighs about 1.2 kg. On an annual basis, this indicates that each household would gain about $35 per year in welfare if current free range chicken purchases were to have traceability and safety branding. This translates into an

annual welfare increase of $66 million for the 1.9 million residents of the urban districts of Ha Noi. Private or public measures to improve traceability and increase safety branding have a potential to both increase consumer welfare, but also decrease public health risk.

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