



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Consumers' Willingness-to-Pay of Different Pork Preservation Methods in Chinese Retail Market

Junhong Chen, Purdue University, chen1422@purdue.edu

H. Holly Wang, Purdue University, wanghong@purdue.edu

Junfei Bai, China Agricultural University, jfbai@cau.edu.cn

John Lai, University of Florida, johnlai@ufl.edu

***Selected Paper prepared for presentation at the 2017 Agricultural & Applied Economics Association
Annual Meeting, Chicago, Illinois, July 30-August 1***

Copyright 2017 by Junhong Chen, H. Holly Wang, Junfei Bai and John Lai. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies. Because this is a preliminary draft, please do not cite without authors' permission.

Consumers' Willingness-to-Pay of Different Pork Preservation Methods in Chinese Retail Market

Junhong Chen, H. Holly Wang, Junfei Bai, John Lai

Meat as a perishable food appears in markets in a variety of forms. In a traditional economy, “hot meat” from freshly butchered animals is sold undressed or dressed cutting by demand on site as the primary form (Brown et al, 2002; Bhandare et al., 2007). As the infrastructure improved with cold chains, precut meat packaged with plastic wrap is the most popular form in today's grocery stores. Frozen meat in vacuum package is also common for high valued meat especially imported meat to prolong its shelf life. Active packaging with atmosphere controlled methods such as MAP and/or CAP started to emerge in high end supermarkets in developed countries (Kerry et al, 2006; Zhou et al, 2010).

The preservation methods are directly related to the infrastructural conditions, types of markets and marketing, spatial flows of products, and trade. Either due to traditional habit, cuisine culture, or knowledge of the industrial methods, consumers may have preferences on one or another methods. Such preferences will have effects on market demand of meat, and have caught the attention of economists and the market practitioners (Troy and Kerry, 2010; Grebitus, et al., 2013). Most of the studies, such as mentioned, focus on newest methods developed by scientists and their market impact on developed countries. The vast sized market in emerging economies are missed in literature.

China is the world largest pork producer and consumer with 55 and 56 million metric tons respectively, realizing a one million ton net import (USDA FAS 2016). As an emerging economy, its GDP growth remains strong, per capita income increases fast, and domestic and international supermarkets are built widely in fast expanding urban areas. People not only

consume more meat and other animal protein, but also pay more attention on meat quality and safety, as well as country of origin (Ortega et al, 2012; Boyer and Han, 2009; Wang, et al., 2009). Especially concerned by recent food safety scandals from domestic products (Yan, 2012; Ortega, et al., 2011), Chinese consumers favors high quality meat imported from developed countries (Ortega, et al., 2016; Wong, 2014). However, a significant percentage of Chinese consumers still buy hot meat from wet markets, and consider chilled and/or frozen meat as less fresh. Moreover, some consumers tend to prefer local-grown food over food shipped from far or imported (Chung, Boyer and Han, 2009; Alfnes, 2004; Loureiro and Umberger, 2003). Chinese market provides a very interesting subject for the study of consumer preference on meat preservation methods, and its marketing and trade implications, both of which are lack in the existing literature.

With the innovation of preservation technologies for fresh meat, people started to pay more attention to chilled and frozen products. Zhou et al (2010) pointed out that chilling meat plays an essential role for hygiene, safety, shelf life, appearance, and quality. Lawrie and Ledward (2006) add that freezing can extend the storage life of meat and decrease the chance of deterioration during storage. The objective of this paper is to study consumers' preference for different attributes of pork, especially the preservation methods attributes and evaluate the willingness-to-pay (WTP) on the attributes, and study the implications of such preferences on the marketing and trade of pork.

Methods

According to Lancaster (1966), consumers make their consumption decisions based on maximizing the utility derived from attributes of goods. The utility has a deterministic and a random component, V and ε , respectively.

$$U = V + \varepsilon. \quad (1)$$

The deterministic component depends on the attributes of the product consumed assuming linearly,

$$V = x\beta, \quad (2)$$

where x is a vector of product attributes, and β is the corresponding parameter vector.

Given the attribute choice is discrete mostly, a consumer will choose the combination of attributes, denoted by x_i , over all other combinations of x_j , in the available choice set A , only when

$$V_i + \varepsilon_i > V_j + \varepsilon_j \text{ for all } i \neq j \in A \quad (3)$$

Choice experiment is a standard methods adopted today in consumer preference analysis focusing on discrete attributes, such as Lusk, Roosen and Fox (2003), Lusk and Schroeder (2004), and Ortega et al. (2015). Given randomly designed the choice sets of alternatives, consumers are asked to make a choice of which alternative to buy (or not to buy), and the decision is observed. Treating such observations as a random sample, the probability that a consumer makes such a choice is as follows:

$$P_i = Prob(V_i + \varepsilon_i > V_j + \varepsilon_j) \forall j \in A \text{ and } i \neq j, \quad (4)$$

and the Logistic distribution is used to describe the probability, assuming that the stochastic component ε_i is independent and identically distributed for all observations:

$$P_i = \frac{e^{x_i\beta}}{\sum_j e^{x_j\beta}} \quad (5)$$

Data

A choice experiment survey was conducted in Beijing, Shanghai, Guangzhou and Chengdu in China from August to September of 2013. These four cities are the economic centers in

norther, east, south and west part of China. We randomly selected three supermarkets in each city including international and domestic chains in different sizes. Seventy consumers were randomly asked to complete the survey in each store in an in-person interview style over different time of a day and different days of a week. The total number of respondents was 840 with 833 completed questionnaires.

The choice experiment survey is designed through dichotomous choices (Kanninen, 1993). The attributes we consider are preservation methods with three levels, hot, chilled and frozen; packages with three levels, unpacked, plastic-packed and seal-vacuumed packed¹; place of origins with four levels, local province, other domestic provinces, US imported and EU imported, and three levels for price, ¥20/Jin², ¥30/Jin, and ¥40/Jin. There are 108 possible combinations to form one choice alternative, and 76 alternatives are finally constructed after we removed the unreasonable and trivial ones, such as imported hot pork. Putting two alternatives together with opt-out, we have 5,700 scenarios. Each survey respondent was asked to complete six scenarios. Figure 1 is an example of a choice scenario from the survey, allowing an opt-out alternative.

	Choice 1	Choice 2	Choice 3
Price	RMB20/Jin	RMB30/Jin	Neither one
Origins	Local	United States	
Preservation	Hot meat	Chilled meat	
Package	No package	Sealed Vacuum	
I will buy			

Figure 1 Sample Choice Experiment Survey

¹ MAP and CAP are not available for pork in China.

² One USD (\$) is about 6.2 Chinese Yuan (¥) during the survey period. One Jin is half a kilogram.

Assuming consumers' preference over the preservation methods are affected by their understanding about them, an important question is asked before they take the choice experiments about their knowledge of the preservation methods. Around 42% of the total survey participants didn't know the definition of chilled meat. For those who thought they knew the difference, about 44% didn't know the difference between hot meat and chilled meat, and 7% of those thought there was no difference. We created a composite a dummy variable, *knowledge*, for those who claim they know what chilled meat means, and 58% of respondents fell in this category.

To investigate the effect of the knowledge, we provided educational information about these preservation methods in the middle of the experiment, that is after they finish the first three choice scenarios and before the other three. Informational intervention has been used in similar studies, such as Besley & Burgess (2002), Stromberg (2004), and Ortega et al. (2015). A dummy variable, *info*, is used to denote the choices made after the information infusion. The information is provided with a card as in Figure 2.

	Hot meat	Chilled meat	Frozen meat
Process method	Carcass with no refrigeration; sold within 2-4 hours after slaughtered	With refrigeration; low down and keep the body temperature of 0-4°C within 24 hours after slaughtered	Carcass with frozen process; down to and keep the body temperature of -18°C after slaughtered
Taste	Firm	Soft	Firm
Thawing	No need	No need	Need

Safety	Low no refrigeration; being vulnerable to bacteria reproduction and cross contamination	High Keeping refrigeration to postpone the massive bacteria reproduction	High Frozen processing to prohibit the massive bacteria reproduction
Quality guarantee	Half a day or shorter under room temperature	3-7days under 0-4°C	more than one year under -18°C

Figure 2 Information Card about Meat Preservation Methods

Questions about consumptions of chilled, frozen and hot pork were asked and they reveal some spatial differences. Consumers in Guangzhou and Chengdu buy more hot pork than their counterparts in Beijing and Shanghai, and hot pork is the majority of their consumption in those two former cities (Table 1).

Table 1 Meat Consumption Preference

Consumption (%)	Chilled Meat	Hot Meat	Frozen Meat
Total	45%	46%	9%
Beijing	60%	28%	12%
Shanghai	47%	45%	8%
Guangzhou	30%	61%	9%
Chengdu	36%	57%	7%

Demographic information is also collected to capture the heterogeneity among consumers. Age, gender and education are included in this study. *Male* is a dummy variable, and the *age* and *edu* are continuous variables measured by years of life and education. In general, we have 24% male survey respondents which agrees with the culture of female dominated shoppers.

The average age is 45.3 years old, average schooling is 11.6 year, and about 31% with college or higher education levels. The detailed descriptive analysis can be found in She et al., (2015).

Boxall and Adamowicz (2002) stated that consumers' preferences are heterogeneous, and the random parameter logit model is applied, where the coefficient vector β is random across consumers. Assuming the distribution of the β vector is joint normal with a joint density function $f(\beta)$, the expected probability that a consumer chooses alternative i is represented as:

$$P_i = \int \frac{e^{x_i\beta}}{\sum_j e^{x_j\beta}} f(\beta) d\beta. \quad (6)$$

The marginal density of any pre-restricted non-random coefficient in the vector is set with value 1 at the deterministic level β_c and value 0 at all other levels. The mean vector and variance-covariance matrix can be estimated as parameters. If any coefficient is non-random, its variance would come out as zero.

Our base model is for the main attributes (prices, origins, package and types of meat) only. The second and third are model with knowledge and with educational information intervention interacted with the preservation methods. The next two models are introduced with interaction variables to the place of origin, and the last model includes the interaction with demographics.

In the base model, we use

$$V = \beta_0 OptOut + \beta_1 EU + \beta_2 Local + \beta_3 US + \beta_4 Vacuum + \beta_5 Plastic \\ + \beta_6 Chilled + \beta_7 Frozen + \beta_p Price \quad (7)$$

to analyze how each attributes influence consumers' utility.

OptOut is a dummy variable representing the opt-out alternative. All other variables are dummy variables taking value 1 when the corresponding attribute is present, except price taking actual cardinal values. For all the variables, value zero is only used for the opt-out alternative,

and value -1 when the attribute is not present, so called effects coding (Lusk et al., 2003; Ortega et al., 2011). The default category is pork from other domestic provinces, without package and hot.

The purpose of this project is to quantify consumers' willingness to pay (WTP) for alternative attributes and examine how raising consumers' awareness of different types of pork can influence their preferences. The WTP is calculated based on estimated parameter of each attributes and estimated price coefficient. WTP is estimated as:

$$WTP_k = -2 \frac{\beta_k}{\beta_P}, k = 0, 1, \dots, 7 \quad (8)$$

It is the ratio of the marginal utility of the kth attribute and the marginal utility of price. Because the attributes are dummies and the price is the cost of the good, this negative ratio is the tradeoff between cost and gain of the attribute, and the coefficient of 2 comes from the effects coding.

According to Krinsky and Robb (1986), the parametric bootstrapping technique is applied to measure the confidence intervals for WTP estimates in each model. Moreover, the simulation of a distribution of 1000 observations for each WTP estimate was conducted via drawing from a multivariate normal distribution that originated from the coefficient and variance terms from the models. Following the Hole (2007), even though this method may have resembling results as the delta method, the WTPs are assumed to be symmetrically distributed. Their distributions are estimated in Matlab R2014a.

We introduce the *knowledge* and *info* variables in four additional models. In Model 2 we interact the *knowledge* with both preservation and package variables, and in Model 3 we interact the *info*. We do the same to place of origin variables in Models 4 and 5. Demographic variables are introduced as interactors in Model 6, as they are often suggested to influence consumers' preferences in the literature (Carpio et al., 2008; Chung et al., 2009; Hu et al., 2004).

Results

We conducted the random parameters logit model estimation in NLOGIT version 4.0, restricting the price coefficient to be nonrandom. Table 2 shows the result of the base model (Model 1). The standard deviations of all attribute coefficients are all statistically significant at 1% level, which confirm the necessity of the random parameter model and suggest the presence of consumers' preference heterogeneity. All of the estimated means of the coefficients are highly statistically significant at 1% level, meaning that they all contribute to the utility either positively or negatively.

Table 2 Base Model Random Parameter Logit (RPL) Estimation

Base model	Mean coefficient	Standard deviation	Mean WTP	[95% C.I.]
Opt-Out	-36.639	.44520D-09	NA	
EU	-0.365 ***	.72635***	-18.79	[-25.99,-12.52]
Local	0.656 ***	.46471***	33.69	[25.78,43.84]
US	-0.443 ***	.84310***	-22.87	[-31.88, -16.07]
Vacuum	0.457 ***	.61102***	23.53	[17.34,30.73]
Plastic	0.294 ***	.42090***	15.14	[10.45,20.91]
Chilled	0.162 ***	.66225***	8.48	[2.66,15.26]
Frozen	-0.355 ***	.57540***	-18.19	[-25.75,-11.51]
Price	-0.039 ***	NA	NA	

Notes: Models were estimated using NLOGIT 4.0. and Matlab R2014a. Significance indicate by (10%)*, (5%)**, and (1%)***.

Because the logit model coefficients have no direct economic meaning, we reported each attribute's mean WTP and 95% confidence intervals on the right side of the Table 2, except those with insignificant mean coefficients. As for country of origin attribute, only local province had a positive coefficient, indicating that consumers had the highest utility from pork produced in their local provinces, followed by other domestic provinces, while imported from EU and US are less preferred if all other attributes are held constant. This explains the situation in China that people

may find that pork imported from other countries is not as fresh as the domestically produced due to long transportation time and different pork taste. Furthermore, sealed vacuum package has the highest WTP of 23.53¥/Jin, and it was preferred over plastic packages and unpacked pork. In Chinese retail market, vacuum sealed meat is not often seen, unless for high end products, often imported. The preference of plastic packed meat reflect urban consumers in these four topline cities have started to embrace the modern style of shopping in supermarkets with prepacked meat instead of in wet market asking the butcher onsite to cut. When it comes to pork preservation methods, consumers derive highest utility by consuming chilled pork and are willing to pay RMB 8.48 /jin more than hot port, but lowest utility for frozen pork with -18.19¥/Jin.

The mean WTPs and their 95% confidence intervals for the interaction modes 2 through 5 are reported in Table 3. Attributes whose coefficients are insignificant are excluded. Most signs and relative sizes of the WTP remains similar as in the base model, however, model 2 shows that those who don't have the knowledge about the preservation methods prefer the chilled and hot pork the same, while those with knowledge prefer the chilled pork with 11.27¥/Jin WTP over those without the knowledge. Although both groups do not prefer frozen pork over hot pork, those with the knowledge discounted the frozen pork 11.84¥/Jin less than those without the knowledge. This show the correct knowledge of preservation methods alleviate people's skeptics about the preserved meat compared to the hot meat.

Table 3 WTP Results with Interacting Knowledge and Information Infusion

	Model 2		Model 3		Model 4		Model 5	
	WTP	[95%C.I.]	WTP	[95%C.I.]	WTP	[95%C.I.]	WTP	[95%C.I.]
Opt-Out	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EU	-16.99	[-11.10,-23.69]	-17.11	[-23.97,-11.43]	-19.54	[-31.41,-9.03]	-13.11	[-23.01,-4.55]
local	31.2	[24.39,40.15]	31.13	[24.38,39.41]	35.11	[24.55,48.17]	36.15	[26.15,49.58]
US	-23.1	[-31.33,-16.21]	-22.76	[-31.40,-15.74]	-32.97	[-47.48,-21.72]	-25.67	[-38.83,-15.05]
Vacuum	20.59	[15.23,26.96]	20.62	[14.95,27.37]	23.06	[16.90,30.17]	22.22	[15.92,30.43]
Plastic	13.04	[8.61,18.07]	13.14	[8.67,17.99]	15.08	[10.33,20.33]	14.23	[8.96,20.43]
Chilled	-9.14	[-20.02,2.09]	N/A	N/A	8.97	[3.01,15.26]	11.86	[4.66,19.20]
Frozen	-35.32	[-49.86,-23.12]	-30.23	[-40.89,-21.60]	-18.26	[-26.02,-11.78]	-11.74	[-20.04,-4.69]
Know*Chilled	11.27	[5.22,17.31]						
Know*Frozen	11.84	[5.74,18.26]						
Info*Chilled			25.01	[15.14,36.04]				
Info*Frozen			26.99	[17.16,38.61]				
Know*EU					NA	NA		
Know*local					NA	NA		
Know*US					6.421	[0.44,12.64]		
Info*EU							NA	NA
Info*local							-13.37	[-24.50,-3.71]
Info*US							9.9	[-1.71,22.61]

Notes: Models were estimated using NLOGIT 4.0. and Matlab R2014a. Significance indicate by (10%)*, (5%)**, and (1%)***.

Model 3 shows the educational information consumers received have similar but stronger effects as the knowledge. This is because the information is scientific, which educates those who don't have the knowledge and enhances the knowledge who already have, and also because it is freshly provided at the choice decision time. With the 26.99¥³Jin WTP increase after they receive the information, their WTP to the frozen meat gets quite close to hot meat, indicating consumers might have misunderstood the frozen meat. These results showed that information helping consumers to understand how different meat preservation methods work plays an important role in consumers' perception towards those methods and purchasing decisions. Combining both Models 3 and 4, with or without the knowledge being educated with the scientific information or not, Chinese consumers consistently prefer chilled meat over hot meat over frozen meat.

Models 4 and 5 show that the self-identified knowledge of preservation methods will help consumers' acceptance of pork imported from the US, but not other place of origin. The provided scientific information will improve the acceptance of the US imported pork with a stronger effect, bringing the WTP to about 15¥/Jin below Chinese domestic pork relative to the 22¥/Jin below across all other models. While the information will reduce the WTP premium of local pork from about 33¥/Jin across other models to 23¥/Jin. So the information closes the gap associated with the spatial distance between the place of origin and the place of consumption.

Because local-grown pork is often for sale at local wet market or small butcher's store using unsafe preservation methods, respondents are aware of the disadvantages of hot meat compared with chilled and that hot meat is not always fresh. Moreover, since almost all imported pork is frozen, the changes in WTP for imported pork indicated that people understood that

³1 Jin is half kilogram.

frozen meat was not as bad and freezing meat didn't mean losing freshness. As information about frozen meat preservation method is known to the public, it is possible that people will value imported pork more.

In order to identify the impact of individual characteristics on consumers' choices when purchasing pork, demographic factors, *age*, *male* and *edu*, are interacted with the main attributes in the base model (Table 4). Age has an effect on the WTP of almost all attributes. Older consumers tend to be more traditional and conservative to accept new technology, showed by their less willing to pay for imported and vacuum packed meat and more willing to pay for local meat. Interestingly, the WTP premium for chilled pork over hot pork increases with the age. This results support the previously base model results that chilled pork is no longer a new method but accepted as a standard preservation method among Chinese urban consumers in these top cities.

Table 4 Estimation of Interacting Demographic Variables to the Base Model

	Mean coefficient		Mean WTP	[95%C.I.]
Opt-Out	-36.795		N/A	N/A
EU	-0.411		N/A	N/A
Local	0.391	*	26.65	[-1.886,58.172]
US	-0.517	*	-34.32	[-76.509,2.322]
Vacuum	0.646	***	44.06	[9.362,79.256]
Plastic	0.28		N/A	N/A
Chilled	-0.891	***	-59.69	[-107.508,-20.545]
Frozen	-1.059	***	-70.36	[-118.337,-31.911]
age*EU	-0.005	*	-0.34	[-0.741,0.032]
age*local	0.005	**	0.17	[0.004,0.352]
age*US	-0.005	*	-0.39	[-0.809,0.004]
age*vacuum	-0.007	**	-0.46	[-0.877,-0.106]
age*plastic	-0.003		N/A	N/A

age*chilled	0.01	***	0.71	[0.288,1.213]
age*frozen	0.008	**	0.54	[0.128,1.011]
edu*EU	0.037	**	2.58	[0.593,4.970]
edu*local	-0.015		N/A	N/A
edu*US	0.043	***	2.88	[0.682,5.293]
edu*vacuum	-0.001		N/A	N/A
edu*plastic	0.005		N/A	N/A
edu*chilled	0.044	**	2.96	[0.690,5.580]
edu*frozen	0.037	**	2.40	[0.166,4.858]
male*EU	-0.202	**	-13.88	[-28.830,-0.239]
male*local	0.051		N/A	N/A
male*US	-0.325	***	-22.21	[-39.506,-7.567]
male*vacuum	-0.015		N/A	N/A
male*plastic	0.034		N/A	N/A
male*chilled	0.113		N/A	N/A
male*frozen	0.204	*	7.61	[-7.643,24.083]

Notes: Models were estimated using NLOGIT 4.0. and Matlab R2014a. Significance indicate by (10%)*, (5%)**, and (1%)***.

Education has a positive impact on the WTP for imported, chilled, and frozen meat. One year more schooling will result in 2.4 to 3¥/Jin WTP more on each of these attributes. However, when education is interacted with package factors in the model, it is statistically insignificant, which suggests that there is no direct relationship between education level and package preferences for consumers. As for the difference between genders, males have lower WTP for imported meat but higher WTP for frozen meat than females. There is no significant relationship between gender and packaging preferences.

We have collected other demographic information such as ethnics, income, employment and marriage status, and whether having children and/or seniors living together. However, these variables are by and large not affecting the preferences.

Conclusions

Raw meat preservation technology is progressing very fast, but it takes time and effort for consumers to understand and accept it. In the vast pork market in China, consumers are in the process to transforming from shopping at the traditional wet market for unpacked hot meat to shopping at modern grocery stores for packaged chilled or even high end vacuum sealed chilled or frozen imported meat cuts. This study fills the gap in the literature that consumers' preferences of preservation methods are understudied.

Our results show that Chinese consumers prefer chilled, packaged and locally produced pork, and they discount frozen and imported pork even below hot pork. Although about half of the shoppers still buy hot pork from wet market, chilled and plastic packaged pork in supermarkets is already a common product and has been quite accepted by consumers young and old. However, many of the shoppers don't understand the chilling and freezing preservation methods and their effects on the quality and safety of the meat, resulting in under value of chilled especially frozen meat.

When the scientific information is provided, a significant effect can be observed on these consumers' preferences and shopping behaviors, in that their willingness to pay increases for frozen and chilled meat, and for imported meat. This suggests that without proper knowledge, there exists intertwined perception that imported meat or meat from other provinces within the country means frozen or under long period preservation, less fresh with poor taste and texture.

As more high end grocery stores and online retailers emerging to sell imported meat in vacuum sealed packages mostly frozen to for package preference, consumers start to recognize

the value of seal-vacuumed package. Chinese consumers show a higher acceptance to pork imported from EU than the US, because pork from EU countries like Germany and Demark have been shipped more to this market than from the US. The information education to consumers bring a big positive impact on their acceptance to the US pork.

Females who are the majority of Chinese grocery shoppers and younger shoppers are more willing to buy imported pork. Education levels also contribute to chilled, frozen and imported products.

Many developing and emerging economic countries like China are improving their infrastructure for retailing, improving the food safety, quality and availability to their citizens. Introducing raw meat packaging and preservation technology to consumers can help expand the market and supplementing the local low efficient livestock production with national and international resources. Providing scientific information to consumers is an effective way to achieve this.

References

- Alfnes, F. (2004). Stated Preferences for Imported and Hormone-treated Beef: Application of a Mixed Logit Model. *European Review of Agricultural Economics*, 31(1), 19-37.
- Bhandare, S. G., Sherikar, A. T., Paturkar, A. M., Waskar, V. S., & Zende, R. J. (2007). A comparison of microbial contamination on sheep/goat carcasses in a modern Indian abattoir and traditional meat shops. *Food Control*, 18(7), 854-858.
- Besley, T., & Burgess, R. (2002). The political economy of government responsiveness: Theory and evidence from India*. *Quarterly Journal of Economics* 117 (4), 1415–1451.
- Boxall, P.C., and Adamowicz, W.L. (2002). Understanding Heterogeneous Preferences in Random Utility Models: A Latent Class Approach. *Environmental and Resource Economics* 23 (4), 421–446.
- Brown, C. G., Longworth, J. W., & Waldron, S. (2002). Food safety and development of the beef industry in China. *Food Policy*, 27(3), 269-284.
- Carpio, C. E., and Isengildina-Massa, O. (2009). Consumer Willingness-to-Pay for Locally Grown Products: the Case of South Carolina. *Agribusiness*, 25(3), 412-426.
- Chung, C., Boyer, T. and Han, S. (2009). Valuing Quality Attributes and Country of Origin in the Korean Beef Market. *Journal of Agricultural Economics*. 60(3):682-698.
- Grebitus, C., Jensen, H. H., Roosen, J., & Sebranek, J. G. (2013). Fresh meat packaging: Consumer acceptance of modified atmosphere packaging including carbon monoxide. *Journal of Food Protection*, 76(1), 99-107.
- Greene, W. H. (1993). *Econometric Analysis*. Engelwood Cliffs.
- Hole, A. R. (2007). A comparison of approaches to estimating confidence intervals for willingness to pay measures. *Health Economics*, 827-840.
- Hu, W., Hünemeyer, A., Veeman, M., Adamowicz, W., and Srivastava, L. (2004). Trading off Health, Environmental and Genetic Modification Attributes in Food. *European Review of Agricultural Economics*, 31(3), 389-408.
- Kanninen, B. J. (1993). Optimal experimental design for double-bounded dichotomous choice contingent valuation. *Land Economics*, 138-146.
- Kerry, J. P., O'grady, M. N., & Hogan, S. A. (2006). Past, current and potential utilisation of active and intelligent packaging systems for meat and muscle-based products: A review. *Meat science*, 74(1), 113-130.

- Khodaverdizadeh, M., Kelashemi, M. K., Hayati, B., and Molaei, M. (2009). Estimation of Recreation Value and Determining the Factors Effective in Visitors' WTP for Saint Stepanus Church Using the Heckman Two-stage and CV Methods. *World Applied Sciences Journal*, 7(4):543-551.
- Krinsky, I., & Robb, L. A. (1986). On Approximating the Statistical Properties of Elasticities. *The Review of Economics and Statistics*, 68(64): 715-719.
- Lawrie, R.A., & Ledward, D.A. (2006). Lawrie's Meat Science. Seventh English, edition ed. *Cambridge England: Woodhead Publishing Limited*.
- Lancaster, K. J. (1966). A New Approach to Consumer Theory. *Journal of Political Economy*. Vol. 74, No. 2, pp. 132-157.
- Loureiro, M.L., and Umberger, W. J. (2003). Estimating Consumer Willingness to Pay for Country-of-Origin Labeling. *Journal of Agricultural and Resource Economics*. 28(2). pp. 287-301.
- Lusk, J. L., Roosen, J., & Fox, J. A. (2003). Demand for Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn: A Comparison of Consumers in France, Germany, the United Kingdom, and the United States. *American Journal of Agricultural Economics*, 85(1), 16-29.
- Lusk, J. L., & Schroeder, T. C. (2004). Are choice experiments incentive compatible? A test with quality differentiated beef steaks. *American Journal of Agricultural Economics*, 86(2), 467-482.
- National Bureau of Statistics of China. (2016). 2016 China Statistical Yearbook.
- Ortega, D. L, Hong, S. J., Wang, H. H., & Wu, L. (2016). Emerging Markets for Imported Beef in China: Results from a Consumer Choice Experiment in Beijing. *Meat Science*, 121:317-323.
- Ortega, D.L., Wang, H.H., Olynk, N. J., Wu, L., and Bai, J. (2012). Chinese Consumers' Demand for Food Safety Attributes: A Push For Government and Industry Regulations. *American Journal Agricultural Economics*. 94(2) pp. 489-495.
- Ortega, D.L., Wang, H.H., & Olynk Widmar, N.J. (2015). Effects of media headlines on consumer preferences for food safety, quality and environmental attributes. *Australian Journal of Agricultural and Resource Economics*, 59:433-445.

- Ortega, D.L., Wang, H.H., Wu, L., & Olynyk, N.J. (2011). Modeling Heterogeneity in Consumer Preferences for Select Food Safety Attributes in China. *Food Policy*. 36:318-324.
- She, Z., Bai, J., Liu, J., Joel, H. (2015). Consumers' Awareness of and Willingness to Buy Chilled Pork in Urban China. *Food and Nutrition in China*. 21(4), 42-46.
- Stromberg, D. (2004). Radio's impact on public spending. *The Quarterly Journal of Economics*. 119 (1), 189–221.
- The World Bank, OECD National Accounts Data (2015). Retrieved from <http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG>
- Troy, D. J., & Kerry, J. P. (2010). Consumer perception and the role of science in the meat industry. *Meat science*, 86(1), 214-226.
- United States Department of Agriculture. (2016). Livestock and Poultry: World Markets and Trade. Foreign Agricultural Service.
- USDA FAS. (2016). China Livestock and Products Semi-annual: China's Pork Imports to Increase in 2016. GAIN Report, CH16026, April 5.
- Wang, F., Zhang, J., Mu, W., Fu, Z., & Zhang, X. (2009). Consumers' perception toward quality and safety of fishery products, Beijing, China. *Food control*, 20(10), 918-922.
- Wong, B. (2014). Chinese consumers increasingly sensitive to imported food origins. Hong Kong Trade Development Council Research, July 8. <http://economists-pick-research.hktdc.com/business-news/article/Research-Articles/Chinese-consumers-increasingly-sensitive-to-imported-food-origins/rp/en/1/1X000000/1X09Y4XR.htm>. Viewed on March 20, 2017.
- Yan, Y. (2012). Food Safety and Social Risk in Contemporary China. *The Journal of Asian Studies*. Vol. 71. Issue.03. pp. 705-729. DOI: 10.1017/S0021911812000678.
- Zhang, M., Qiao, H., Wang, X., Pu, M., Yu, Z., & Zheng, F. (2015). The Third-Party Regulation on Food Safety in China: A Review. *Journal of Integrative Agriculture*, 14(11), 2176-2188.
- Zhou, G.H., Xu, X.L., & Liu, Y. (2010). Preservation Technologies for Fresh Meat-A Review. *Meat Science*. 86. 119-128.