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Consumer attitudes to different pig production systems: a study from mainland China

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Abstract In many countries consumers have shown an increasing interest to the way in which food products are being produced. This study investigates Chinese consumers' attitudes towards different pig production systems by means of a conjoint analysis. While there has been a range of studies on Western consumers' attitudes to various forms of food production, little is known about the level of Chinese consumers' attitudes. A cross-sectional survey was carried out with 472 participants in 6 Chinese cities. Results indicate that Chinese consumers prefer industrial pig production systems, where traditional pig breeds are raised, over large-scale and small family farms. Farms with maximum attention to food safety, which furthermore can provide lean meat with consistent quality, are also preferred. Imported pig breeds and tasty but variable meat were rejected. A 3-cluster solution found that consumers from cluster 1 focus almost exclusively on the food safety aspect (*food safety focused*). Consumers from cluster 2 (*indifferent*) show weak overall attitudes to pig production systems in general. Cluster 3 (*industrial production oriented*) stands out by being very positive about industrial, large-size farms and consistent quality. From a Chinese consumer's perspective, the industrial approach seems to represent values such as achievement and evolution, as well as quality and safety, since pig production is moving away from low-cost, low-quality, and low-safety family-scale systems. A complex set of rural and environmental development, quality aspects, and food safety measures are challenges that must be met by the stakeholders of pig production systems in China.

Keywords Consumers · Pig production systems · China · Survey · Conjoint analysis

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Introduction

In recent years, consumer demand for innovative, high-quality, safe, and healthy food products is re-shaping agri-food chains worldwide (Lockie 2009). One aspect that has drawn particular attention is consumers' attitude not to the product itself, but to the way in which this product is being produced (Abrams et al. 2010; de Barcellos et al. 2010). In many Western countries consumers have shown an interest in issues like animal welfare (e.g., Frewer et al. 2005; Boogaard et al. 2006; Verbeke 2009), organic production (e.g., Zanoli and Naspetti 2002; Hoefkens et al. 2009; Thøgersen 2010), and use of genetically modified organisms (GMOs) (e.g. Grunert et al. 2003). This interest may be driven by beliefs that such attributes of the production

system affect final product quality and safety (Grunert 2005), but are also driven by ethical and environmental considerations. Attitudes to the way food is being produced have an impact not only on consumer demand for these products, but may via social discourse in the public arena affect legislation, leading to changing requirements imposed on food producers. Pig production has been a case that has attracted special attention, with stocking density, housing issues, and environmental impact of pig production being some of the major issues that have been discussed and investigated (Kanis et al. 2003; Ngapo et al. 2003; Krystallis et al. 2009; Vanhonacker et al. 2009).

In the Western world and especially in Europe, consumer interest in agricultural production has been fuelled by a series of food scares that happened in the 1980s and 1990s. According to Tanaka (2008, p. 569), when a food safety crisis occurs, various social actors (such as farmers, processors, distributors, retailers, consumers, regulators) individually and collectively "move from the taken-for-granted life world to the 'problematic world' by opening up 'black boxes' of how particular food items are produced, distributed, and regulated. Yet, the knowledge about food is not distributed equally among social actors involved in food production, distribution, and consumption. Many actors, particularly consumers, often find themselves surprised and shocked by what is in the black boxes." One of the results was a general loss of consumer trust in actors in the food chain that only slowly recovered as institutional changes in the assessment and management of food risks were implemented (Wales et al. 2006; de Jonge et al. 2008; van Dijk et al. 2008). Still, a heightened consumer interest in the agricultural and food production process has remained, and has mainly taken the form of skepticism with regard to large scale and industrial food production (Corcoran et al. 2001; Grunert 2006). This, in turn, has paved the way not only for growth in organic production, but also a renewed interest in various forms of local and traditional food production (e.g., Krystallis et al. 2007).

Against this background, it is interesting to look at current developments in China. China is a country with considerable food safety problems and a series of recent food scares, of which the use of melanin in dairy production (Nielsen 2009) and the use of clenbuterol in pig production may be the most well-known ones. This has resulted in considerable consumer awareness of food safety issues and considerable distrust in food chain actors (Wu et al. 2010; Wu et al. 2011). In response, the Chinese government has made food safety a priority. In addition to stricter enforcement of food safety regulations, a major thrust in the approach the Chinese authorities are taking is the modernization and industrialization of the food chain. Backyard production of pigs, while still sizable, has been declining rapidly, and large-scale industrial production is on the way up (Wang and Xiao 2008). Chinese authorities—who view affordable pork as "important for social stability"—have lifted subsidies in an effort to revive the domestic pig industry. The Chinese Government was expected to invest $390 million in large pig farms in 2011 (Meat Trade News 2011). Also modernization is encouraged in processing, distribution and retailing, leading among other things to a growth of Western style supermarkets at the expense of traditional open food markets.

It is not given, though, that such measures will re-establish trust of Chinese consumers in their food production system. If Chinese consumers had the skepticism of industrial food production seen in Europe, the production intensification policy adopted by the Chinese authorities, while possibly solving some objective safety problems, may have detrimental effects on consumer trust. On the other hand, skepticism towards industrial food production may be a Western phenomenon, and industrialization in food production may be hailed as progress by the Chinese society.

In the present study, we take pig production as a case and investigate Chinese consumers' attitudes to different forms of pig production. We adopt the approach employed by Krystallis et al. (2009) in their study on European consumers' attitudes to pig production systems. Krystallis and colleagues employed a conjoint design, in which respondents were shown descriptions of hypothetical pig production systems constructed from an underlying factorial design of production system characteristics. Farm size, housing and floor type, efforts to protect the environment, fat content, and quality type of pork were included in the European study's design. Respondents evaluated these characteristics, and the contribution of the various production system characteristics to the overall attitude was estimated. They found that housing and environmental issues had most impact, followed by farm size. Based on their data, they distinguished four consumer/citizen clusters, of which the largest had relatively weak attitudes to pig production systems, whereas the others differed in which aspects of the pig production system (farm size, animal welfare, environmental concern) had most impact on their overall attitude. We follow the basic approach developed by Krystallis et al. (2009), but adapt it to the Chinese context, as it will be presented in the methods section.

In the following, we will first give a brief introduction to the Chinese pork meat sector and its role in the Chinese food system. We then describe the methodology of the study, including the development of the measurement instrument, the data collection, and the analyses carried out. We then present results on how different aspects of pig production systems affect Chinese consumers' attitudes to these, both at the aggregate and segment-specific level. We finish with discussing the implications of the results for stakeholders both in China and abroad.

The pork sector in China and the Chinese food consumer

China is by far the largest pork-consuming nation in the world, accounting for half of the world's total pig consumption (USDA 2011a). Among all kinds of meat and meat products consumed, pork is ranked first. There is a rich variety of pork products in China and consumers are increasingly concerned about the quality and safety of pork products (Ho and Vermeer 2004; Lü 2006). Pork has historically been the primary animal protein source in Chinese diets, and its consumption level tripled between 1980 and 2009. In 2009, a Chinese citizen on average consumed approximately 37.6 kg of pork, compared to 11.8 kg in 1980 (ANUALPEC 2010). Chinese consumers are earning higher incomes and shifting consumption away from grains and legumes toward meats, a variation of Bennett's Law, which states that as incomes increase, the source of calories shifts from carbohydrates to animal proteins (Bennett 1941). This is a phenomenon observed in many developing countries. Chinese per capita income increased over 759 % between 1980 and 2006. During that same period, daily per capita consumption of cereals and starchy roots in China decreased 16 %, while per capita meat consumption increased 274 % (Ortega and Wang 2009).

In China, livestock used to provide food for the family, draft power, and manure for fertilizer, and pig production has long been an essential part of animal husbandry, with the total pork production accounting for 65 % of the whole output of meat in 2011 (USDA 2011b). Most pigs and other livestock used to be reared by traditional rural households that are usually not well covered by governmental regulation and have deficiencies with regard to food hygiene and food safety (Expatica 2008). However, the share of China's pork produced by traditional households has declined from 95 % to less than 50 %. Chinese pork production grew rapidly after 1985, when the government lifted state procurement quotas and price controls. Since these market reforms took hold, overall farm sizes are increasing. Many households shifted their focus from crop production to livestock and increased their swine herds from 1 or 2 heads per household to 10, 50, or 100 heads. To keep up with surging demand, large-scale commercial operations were established, typically located near urban population centers, encouraged by growing applications of imported technologies and management practices. Dozens of large hog commercial operations have emerged outside major cities, raising 1,000 plus animals (Ortega and Wang 2009). The entry of some large feed companies, pork processing plants, and grain players into swine production can be partly explained by high pork prices and government subsidy policies to support pork production (Zhang and Trachtenberg 2008). For instance, to encourage larger-sized hog farm development, the government provided subsidies worth RMB 2.5 billion ($366 million) in 2009 targeted to improve hog raising conditions in these facilities. According to the Ministry of Agriculture, farms of 50 hogs or more accounted for 56 % of total slaughter at the end of 2008, up 8 % from the previous year (Woolsey and Zhang 2009).

However, this rapid transition has also caused new challenges. Confinement of hogs combined with low sanitation standards has provided suitable breeding grounds for disease (Ortega and Wang 2009), leading to new food safety issues and consumer concerns about the safety of pork. Furthermore, Chinese consumers too have become more aware of health issues related to pork consumption. The global concerns about obesity and coronary diseases due to high levels of cholesterol coming from food are also having an impact in China (Pingali 2006). Hence, there is a trend towards the production of leaner pig meat. Additionally, as a result of the rapid development of the industrial pig production system, the dumping of untreated waste began to cause serious pollution and soil contamination, another issue of concern not only for authorities, but also the public at large (Schneider 2011).

Little research has been published about the Chinese food consumer so far. A study on Chinese consumers' attitudes towards biotechnology and food safety (Ho et al. 2006) indicated that most consumers lack the most basic understanding of biotechnology and its potential risks. Less than half of the respondents evaluated food safety in China positively. According to the authors, Chinese food scandals involving GM contaminated rice, the illegal recycling of moon-cake fillings, and the outbreak of chicken influenza in Hong Kong and Guangzhou have damaged consumers' trust in food safety. There are also indicators that Chinese consumers are becoming more interested in environmentally friendly practices, organic products (Thøgersen and Zhou 2012; Chen and Lobo 2012), and that they want to avoid buying products made by companies known for harming the environment. Apparently, this new attitude toward environmental sustainability springs from the actions of the PRC government, nongovernmental organizations (NGOs), and the country's growing middle class (Kan 2010).

With China's increasing integration into a global economy, consumer acceptance of the changes that are ongoing in the Chinese food production system is important, as it can slow down or speed up the process of change. An analysis of Chinese consumers' attitudes to pig production systems gives both insights relevant for serving the Chinese consumer and for shedding light on the possible future of Chinese pig production in a global context. It also provides an interesting point of comparison for insights into how consumer attitudes to agricultural and food production have changed in the Western world in the wake of the food crises in the 1980s and 1990s.

Research method

Data was collected through a consumer survey based on personal interviews. Data collection took place in urban centers only, so that the results describe the attitudes of affluent Chinese urbanites and not of the Chinese population in general. Six Chinese cities were chosen for the fieldwork based on considerations of representativeness of the country and prevalence of pig production in the area: Nanjing in the South-Eastern coast region; Chengdu in the Southwest, Wuhan in the centre, Changchun in the Northeast, Beijing in the North, and Guangzhou in the South of China. Participants were recruited at the place of purchase, either a supermarket or a local market that includes a butcher. Eighty interviews were carried out in each city. The samples were equally divided by gender, resulting in a geographical location by place of purchase by gender stratified quota sample. While not allowing for generalization, quota sampling is widely regarded as adequate in cases where existing sampling frames cannot be used (Crawford 1990) and possibly one of the best ways to collect data under current conditions in China, also applied in recent studies in that country (e.g., Grunert et al. 2011; Krystallis et al. 2012). The fieldwork was carried out between January and March 2008. In each city, local university students majoring in marketing were recruited and trained to collect the data. Average time for an interview was 50 min.

The questionnaire used for data collection included four sections: (a) attitudes towards environmental protection and nature, industrial food production, technological progress, animal welfare, and food and environment (in total 26 items; see details in the following section); (b) consumption frequencies of 23 pork products grouped in five categories, as follows: fresh first cut, minimally processed, further processed, pork-based dishes, and pork meat products; (c) 16 verbal descriptions of various pig farms based on a conjoint design, which were presented to respondents and their opinions collected (16 items; see details in the following sub-section); and (d) socio-demographic characteristics of the respondents (10 items). The master questionnaire was developed in English and translated into Chinese by using the procedure of back-translation. Researchers carefully pre-tested the questionnaire through personal interviews with 50 respondents before entering the actual fieldwork. Almost all of the items were measured on 7-point interval rating scales, usually Likert-type agreement scales with end points 1 = "strongly disagree" to 7 = "strongly agree." Items measuring attitudes were drawn from the literature. Attitude towards environmental protection and nature was measured using a reduced five-item version of the New Environmental Paradigm (NEP) scale (Dunlap et al. 2000), for example "humans are severely abusing the environment" (Cronbach's $\alpha = 0.67$). Attitude towards technological progress was measured with five items presented by Hamstra (1991), for example "the degree of civilization of a people can be measured from the degree of its technological development" (Cronbach's $\alpha = 0.66$). Finally, attitudes towards food and environment were measured with a three-item scale obtained from Lindeman and Väänänen (2000), for example, "it is important that the food I eat on a typical day has been prepared in an environmentally friendly way" (Cronbach's $\alpha = 0.72$). All items are listed in Appendix 1. For all attitude scales, summary scores were computed for further analysis.

The investigation of attitudes towards pig meat production systems was done by means of a conjoint analysis. Conjoint analysis models the nature of consumer evaluations of an object or concept in the form of consumer trade-offs among multiple attributes of the objects or concepts. The conjoint model assumes that objects or concepts (here: pig production systems) can be defined as a combination of attributes (called "factors") and that the overall evaluation of an object or concept is determined by part-worths contributed by each attribute level. Conjoint analysis allows the identification of attribute level combinations that are most preferred by respondents and the identification of the relative importance of each attribute (Hair et al. 1998). In our case, the objects to be evaluated are different pig production systems, and the factors are the characteristics of these systems. There are several techniques for identifying conjoint factors and factor levels that are relevant to consumer evaluations of the object in question (e.g., Harrison et al. 1998). In the frame of the present survey, the relevant factors in the conjoint experiment had to tap essential aspects of pig farming that are expected to have an effect on how consumers (who are mostly lay persons as concerns pig farming practices) evaluate pig-farming systems. Krystallis et al. (2009), based on extensive consultation with experts on pig production systems, had used the following factors: density of pigs in the farm, housing and floor type, efforts to reduce impact of the production system on soil, air and water, pigs' feed designed for production of pork with specific fat content, and quality of the final product. After discussion with Chinese consumer researchers and Chinese experts in pig production, this design was adapted in a number of ways. Most notably, the factor environmental impact was replaced by a food safety factor, mirroring the great concern about food safety in the current situation in China, as discussed earlier. Also, the housing and floor type factor was taken out, as it would not be applicable across all forms of pig farming currently in use in China. Instead, a factor on the type of breed—traditional Chinese vs. European—was added, as this turned out to be a major point of discussion in the Chinese pork

sector according to the researchers and experts. For all factors, the factor levels were adapted, resulting in the following final design for the conjoint part of the study:

- Factor 1: density of sows in the farm, expressed as farm size (levels: 1. 1–5 sows, 2. about 400 sows, 3. several thousand sows);
- Factor 2: type of pigs (levels: 1. traditional Chinese breeds, 2. breeds imported from Europe)
- Factor 3: meat type (levels: 1. lean meat, 2. tasty meat)
- Factor 4: efforts to ensure food safety (levels: 1. not a special consideration, 2. special attention, 3. maximum attention)
- Factor 5: quality of the final product (levels: 1. similar quality every time, 2. different quality because of biological variation and changing local conditions).

The conjoint design employed the traditional additive part-worth model, with no interaction effects among factors. The full factorial design based on the above factors and their levels contains $3 \times 2 \times 2 \times 3 \times 2 = 72$ combinations of attribute levels (conjoint "profiles"). A fractional design was generated by the orthoplan procedure in SPSS (v.15.0). The orthoplan procedure generated 16 fully orthogonal factor level combinations, corresponding to 16 different types of pig farming. The verbal descriptions of these 16 pig farms are presented in Table 1. All factor level combinations that are corresponding to different versions of pig meat production systems were realistic and thus any multicollinearity problems due to correlation among factors were eliminated. Each respondent had to indicate how much s/he liked the described system by assigning a score to each system on a 11-point liking rating scale, with end points −5="dislike very much" to +5="like very much." Before the conjoint rating task was executed, respondents filled in the attitudinal parts of the questionnaire and the pork consumption frequency per type part. After the conjoint task, respondents filled in the socio-demographic part.

Frequency of consumption of the 23 different pork products was measured on an 8-point frequency scale, with end points 1 = "never" to 8 = "daily." Answers were converted into daily frequencies in line with Verbeke et al. (2010). These frequencies were then summed across the products in the five categories: fresh first cut, fresh minimally processed, further processed, pork-based dishes, and pork meat products.

After consistency checking (missing values and outliers), 472 valid questionnaires were obtained, equally distributed among the six cities (16.7 % in each). Female respondents represented 49.9 % of the total sample. Mean age of the sample was 39 years (SD = 11.8). The majority had a higher education degree (41.5 %), whereas 38.4 % graduated from high school and 20 % from primary school. The fact that the survey was conducted mainly in big cities (urban areas) might explain why the majority of the respondents had an advanced education (Xinhuanet 2007). In addition, nearly 85 % of the respondents were under 50 years of age, representing the part of the population with the highest educational level. As expected from the dominant position of pork in the Chinese food culture, almost all participants (99.1 %) were pork consumers.

Analysis and results

Part-worth utilities were computed for each individual respondent based on answers in evaluating the 16 pig production systems. Part-worth utilities are scaled to an arbitrary additive constant within each attribute and are interval data. Utilities are then scaled to sum to zero within each attribute (Orme 2010). In general, it means that consumers show preference if the part-worths are positive and non-preference if they are negative.

The left column in Table 2 shows the mean part-worth utilities for the whole sample, together with the weight of each factor, computed as the range of the utilities of the factor divided by the sum of ranges across all factors. The factor weights show that *food safety* had the highest influence on the overall attitude to the different pig production systems, with an importance weight of 49.0 %. The farm size was second most important, with a weight of 19.0 %. The three other factors—*breed, meat type*, and *quality of the final product*—were less important, with weights of 10.9, 8.0 and 13.0 %, respectively.

Concerning farm size, the Chinese consumers were most positive about the industrial pig production system with "hired labor and several thousand sows" (mean utility of 0.271). The "large-scale family farm with as much as 400 sows" and the "small family farm with 1–5 sows, mostly for own use" were both less positively looked upon. Results also showed that for the average Chinese consumer the most preferred pig breed was the one where animals belonged to traditional Chinese breeds, i.e., "pigs that have been used in China for many years" (mean utility of 0.263), as compared to "pigs that are mostly imported from Europe" (−0.26). Results regarding food safety efforts at the farm level indicated, not surprisingly, that Chinese consumers were most positive about pig production systems where "food safety gets maximum attention when raising pigs in this farm, for example by strict veterinary control and strict hygiene regulations" (highest mean utility of 1.338), although systems where "food safety gets special attention when raising pigs in this farm, for example by regular veterinary control and hygiene regulations" were evaluated almost as positively (mean utility 1.095). The farms where "food safety is not a special consideration when raising pigs" were negatively looked

Table 1 Verbal descriptions of pig production systems based on fractional factorial design

Profile no.	Profile description
1	Consider an industrial pig farm with hired labor and several 1,000 sows. The pigs are mostly breeds imported from Europe. These pigs are known for tasty meat. Food safety gets maximum attention when raising pigs in this farm, for example by strict veterinary control and strict hygiene regulations. The farm produces pigs with the aim to deliver the same meat quality every time
2	Consider a small family farm with 1–5 sows, mostly for own use. The pigs are mostly traditional Chinese breeds, i.e. pigs that have been used in China for many years. These pigs are known for tasty meat. Food safety is not a special consideration when raising pigs in this farm. The farm produces pigs with variable meat quality due to biological variation and changing local conditions
3	Consider an industrial pig farm with hired labor and several 1,000 sows. The pigs are mostly traditional Chinese breeds, i.e. pigs that have been used in China for many years. These pigs are known for lean meat. Food safety is not a special consideration when raising pigs in this farm. The farm produces pigs with variable meat quality due to biological variation and changing local conditions
4	Consider an industrial pig farm with hired labor and several 1,000 sows. The pigs are mostly traditional Chinese breeds, i.e. pigs that have been used in China for many years. These pigs are known for tasty meat. Food safety gets special attention when raising pigs in this farm, for example by regular veterinary control and hygiene regulations. The farm produces pigs with the aim to deliver the same meat quality every time
5	Consider a small family farm with 1–5 sows, mostly for own use. The pigs are mostly breeds imported from Europe. These pigs are known for lean meat. Food safety gets special attention when raising pigs in this farm, for example by regular veterinary control and hygiene regulations. The farm produces pigs with the aim to deliver the same meat quality every time
6	Consider a small family farm with 1–5 sows, mostly for own use. The pigs are mostly breeds imported from Europe. These pigs are known for tasty meat. Food safety gets special attention when raising pigs in this farm, for example by regular veterinary control and hygiene regulations. The farm produces pigs with variable meat quality due to biological variation and changing local conditions
7	Consider an industrial pig farm with hired labor and several 1,000 sows. The pigs are mostly breeds imported from Europe. These pigs are known for lean meat. Food safety is not a special consideration when raising pigs in this farm. The farm produces pigs with variable meat quality due to biological variation and changing local conditions
8	Consider a small family farm with 1–5 sows, mostly for own use. The pigs are mostly traditional Chinese breeds, i.e., pigs that have been used in China for many years. These pigs are known for tasty meat. Food safety gets maximum attention when raising pigs in this farm, for example by strict veterinary control and strict hygiene regulations. The farm produces pigs with variable meat quality due to biological variation and changing local conditions
9	Consider a large-scale family farm with as much as 400 sows. The pigs are mostly breeds imported from Europe. These pigs are known for tasty meat. Food safety is not a special consideration when raising pigs in this farm. The farm produces pigs with the aim to deliver the same meat quality every time
10	Consider a small family farm with 1–5 sows, mostly for own use. The pigs are mostly breeds imported from Europe. These pigs are known for tasty meat. Food safety is not a special consideration when raising pigs in this farm. The farm produces pigs with variable meat quality due to biological variation and changing local conditions
11	Consider a large-scale family farm with as much as 400 sows. The pigs are mostly traditional Chinese breeds, i.e., pigs that have been used in China for many years. These pigs are known for lean meat. Food safety gets special attention when raising pigs in this farm, for example by regular veterinary control and hygiene regulations. The farm produces pigs with variable meat quality due to biological variation and changing local conditions
12	Consider a small family farm with 1–5 sows, mostly for own use. The pigs are mostly traditional Chinese breeds, i.e., pigs that have been used in China for many years. These pigs are known for lean meat. Food safety is not a special consideration when raising pigs in this farm. The farm produces pigs with the aim to deliver the same meat quality every time
13	Consider a small family farm with 1–5 sows, mostly for own use. The pigs are mostly traditional Chinese breeds, i.e., pigs that have been used in China for many years. These pigs are known for lean meat. Food safety gets maximum attention when raising pigs in this farm, for example by strict veterinary control and strict hygiene regulations. The farm produces pigs with the aim to deliver the same meat quality every time
14	Consider a small family farm with 1–5 sows, mostly for own use. The pigs are mostly breeds imported from Europe. These pigs are known for lean meat. Food safety is not a special consideration when raising pigs in this farm. The farm produces pigs with the aim to deliver the same meat quality every time
15	Consider a large-scale family farm with as much as 400 sows. The pigs are mostly breeds imported from Europe. These pigs are known for lean meat. Food safety gets maximum attention when raising pigs in this farm, for example by strict veterinary control and strict hygiene regulations. The farm produces pigs with variable meat quality due to biological variation and changing local conditions
16	Consider a large-scale family farm with as much as 400 sows. The pigs are mostly traditional Chinese breeds, i.e., pigs that have been used in China for many years. These pigs are known for tasty meat. Food safety is not a special consideration when raising pigs in this farm. The farm produces pigs with the aim to deliver the same meat quality every time

Table 2 Mean part-worths and factor weights for overall sample and for cluster solution

Conjoint factors and factor levels	Mean part worth utilities			
	Overall sample	Cluster 1	Cluster 2	Cluster 3
*Farm size***				
1–5 sows	−0.237	0.010	−0.066	0.010
400 sows	−0.247	−0.102	**0.046**	−1.009
Several 1000 sows	**0.271**	**0.092**	0.019	**0.999**
Factor weight (%)	0.190	0.091	0.238	0.233
*Breed**				
Chinese	**0.263**	**0.352**	**0.181**	**0.296**
European	−0.263	−0.352	−0.181	−0.296
Factor weight (%)	0.109	0.091	0.139	0.079
*Food safety efforts***				
Not special attention	−2.434	−4.314	−1.107	−2.398
Special attention	1.095	1.974	0.439	1.147
Maximum attention	**1.338**	**2.339**	**0.667**	**1.251**
Factor weight (%)	0.490	0.712	0.382	0.390
*Meat type***				
Tasty	−0.004	−0.047	**0.146**	−0.234
Lean	**0.004**	**0.047**	−0.146	**0.234**
Factor weight (%)	0.080	0.043	0.112	0.067
*Quality of the final product***				
Consistent	**0.365**	**0.050**	**0.176**	**1.159**
Variable	−0.365	−0.050	−0.176	−1.159
Factor weight (%)	0.130	0.062	0.127	0.229
N	472	151	211	110
Cluster size		31.5 %	44.1 %	23.0 %
Cluster interpretation		Food-safety focused	Indifferent	Industrial production oriented

Highest mean part-worths in each factor on the overall sample and per cluster are bolded

** Cluster effect significant, $p < 0.001$, MANOVA; * cluster effect significant, $p < 0.05$, MANOVA

upon by respondents, with a highly negative mean utility value of −2.434. Regarding type of meat Chinese consumers were almost indifferent about tastier versus leaner meat, with both utilities close to zero. Finally, respondents were more positive about pig production systems where "the farm produces pigs with the aim to deliver the same meat quality every time," i.e., consistent pork quality (mean utility of 0.365), compared to systems where "the farm produces pigs with variable meat quality due to biological variation and changing local conditions."

These means do cover considerable inter-individual differences. To uncover them, a cluster analysis was carried out with the 12 part-worth utility variables used as grouping criterion (two-stage cluster analysis consisting of a hierarchical cluster analysis [stage I], followed by the k-means procedure on the hierarchical clusters' centroids). A 3-cluster solution was selected based on statistical criteria and interpretability. Mean part-worth utilities for the three clusters are also presented in Table 2.

Cluster 1 focuses almost exclusively on the food safety aspect, which accounts for 71.2 % of their evaluation of the different production systems. All other factors play a minor role. Consumers from this cluster are identified as *food safety focused*. Cluster 2 has small average utilities across all the factors and is thus the group with generally weak attitudes to pig production systems in general. Consumers in this cluster are therefore defined as *indifferent*. Cluster 3 stands out by being very positive about large, industrial size farms and consistent quality; it is thus a cluster being especially positive about intensive, industrial production, named *industrial production oriented*.

The clusters were profiled by relating them to the three attitudinal constructs, to the consumption indices for the five groups of products, and to demographic characteristics. For attitudes and consumption frequencies, differences between clusters were investigated by ANOVAs and Scheffe post hoc tests. For demographic characteristics, relationships were tested by Chi square tests. However, there were no significant differences between the clusters by gender, age, marital status, education, financial situation and occupation, and thus the only result on demographic characteristics reported is how the cluster membership is distributed across the six cities in which the study took place. These results are reported in Tables 3 and 4.

Differences on the attitudinal measures were generally small, although significant. Cluster 2, with weak attitudes to the issue of pig production systems, also had lower scores on all three attitude measures. There were no significant differences between Clusters 1 and 3. This means that both the *food safety focused* and the *industrial production oriented* exhibited more positive attitudes to environment and nature, more positive attitudes to technological progress, and more concern about food and environment than the *indifferent* consumers.

As for the consumption frequencies, there were no significant differences between the clusters in consumption of

Table 3 Cluster profiling by attitudes and self-reported pork consumption

	Overall sample	Cluster 1 Food safety focused	Cluster 2 Indifferent	Cluster 3 Industrial production oriented
Attitudes[1]				
Environment and nature*	4.959	5.119[a]	4.811[b]	5.023[a,b]
Technological progress*	5.064	5.180[a]	4.924[b]	5.174[a]
Food and environment**	5.375	5.551[a]	5.186[b]	5.494[a]
Pork consumption[2]				
Fresh first cut	1.128	1.101	1.158	1.108
Fresh minimally processed	0.503	0.459	0.542	0.790
Further processed	0.392	0.320	0.438	0.401
Pork-based dishes*	0.625	0.508[a]	0.712[b]	0.618[a,b]
Pork meat products*	0.409	0.273[a]	0.524[b]	0.375[a,b]

a, b denote statistically significant pairs, Scheffe test, $p < 0.05$

* Cluster effect significant, ANOVA, $p < 0.01$; ** cluster effect significant, ANOVA, $p < 0.001$

[1] Sum scores with range 1–7, see Appendix 1 for scale items

[2] Frequency of daily consumption across product categories; see Appendix 2 for list of product categories

Table 4 Cluster distribution across cities (%)

	Overall sample	Cluster 1 Food safety focused	Cluster 2 Indifferent	Cluster 3 Industrial production oriented
Nanjing	16.7	15.9	19.0	10.9
Chengdu	16.7	11.9	12.8	29.1
Wuhan	16.7	15.2	20.4	11.8
Changchun	16.7	29.8	9.0	15.5
Beijing	16.7	17.9	16.1	17.3
Guangzhou	16.7	9.3	22.7	16.4
	100.00	100.00	100.0	100.00
N	472	151	211	110

Distribution between cities significantly different, Chi square test, $p < 0.001$

fresh first cut, fresh minimally processed, and further processed products. However, Cluster 2, the *indifferent* consumers, stood out in having a more frequent consumption of pork-based dishes and pork meat products.

The cross-tabulation with the six cities shows some rather pronounced regional differences. Cluster 1 (*food safety focused)* was especially present in Changchun and hardly to be found in Guangzhou. Cluster 2 (*indifferent*) was especially present in Guangzhou (one of the most populated cities of China), but hardly to be found in Changchun. Cluster 3 (*industrial production oriented*) was especially present in Chengdu.

Results pointed out an interesting fact: to the modern Chinese consumer, the large-scale, industrial food production system is generally well accepted, as it seems to be a way leading to food safety, a highly valuable attribute to consumers. Government incentives and the enlargement of the operations are therefore contributing to the overall development of the pork chain. Nevertheless, while consumers showed concern about food safety and had positive attitudes towards industrial food production, most of the interviewed consumers were indifferent about the way pork products are produced. For emerging markets such as China, the stage leading from awareness to action (in this case awareness about the impacts of pork production and consequent impacts into consumption) is not yet completed. Environmental issues are a new topic in China and the empowerment of the population and better access to information might shape the future in a different way. Food chain stakeholders and researchers should not ignore those trends.

Discussion and implications

Pig production in China is under rapid development. Both demand and supply have been rising, and the small family farm raising a few pigs mainly for own consumption is giving way to large-scale, industrial pig farms (Wang and Xiao 2008). At the same time, there is a widespread concern about food safety, which is reflected both in growing consumer concerns and in the Chinese government having made food safety a priority issue (Wu et al. 2010, 2011).

People's opinions about different ways of producing food can have an impact not only on their preference for certain types of products, but will also shape the public discourse on the agenda and thereby indirectly have an impact on legislations and their implementation. With China having adopted the "basic principles" of a market economy, consumers can by their choice behavior slow down or speed up change processes that the authorities are pushing for. As an example, while the sale of fresh meat in pre-packed form through Western-style supermarkets has safety advantages, and therefore is promoted by the authorities, Chinese consumers' desire to handle fresh meat before purchase is a factor that is slowing down the adoption of these new practices. Also, opinion polls are widely used in China now, and just as in the Western world documented consumer opinions frame and impact the public debate on issues of public interest and thus play a role in legitimizing government actions. Studies like the

present can therefore be of interest for stakeholders both in industry and in government and, when used properly, be used as support both for market actions of food chain members and for political decisions at regional and national levels. In the former case, it can help prevent costly failures on the marketplace, whereas in the latter case it can provide guidance and legitimation to decisions that, in their implementation, require support from authorities at different levels in the society.

The focal variable measured in this study was people's attitude to different ways of producing pigs. In line with attitude theory in social psychology (e.g., Fazio 1990), attitudes should be viewed as psychological tendencies that may become behaviorally relevant in different contexts, most notably when choosing products and when voicing opinions about current and future developments in the agri-food sector. The former can become more important when Chinese pork producers decide to use way of production as a parameter that is communicated to consumers. This process has already started, with several branded lines of pork on the market advertising aspects like breed and geographical origin. The latter will depend on the extent to which issues around pork production become amplified in the public debate (Kasperson et al. 1988). While China is a relatively closed society, the recent scandal about the use of clenbuterol in pig production, where a major TV channel was using a hidden camera to document the widespread use of this banned additive in pig production, indicates that the media increasingly assume a major role in taking up and amplifying food risks and bringing them to public attention. It can thus be expected that Chinese consumers' attitudes and value systems in relation to agriculture and food production will be increasingly challenged and triggered in the near future. A better understanding of these is therefore an important step towards increasing societal welfare and maximizing producer and consumer surpluses in the agriculture and food markets of this emerging economy.

In interpreting the results of this study, it is important to keep in mind that the sample of consumers used in this study was recruited only in big urban environments and therefore is not representative of the overall Chinese population. In addition, people in the big cities can be expected to know less about pig production than those who live in rural areas, because the latter are more likely to be exposed to pig production in their daily lives. This can have an impact both on the strength and the direction of attitudes. For instance, 44 % of our sample—the cluster we called *indifferent*—had only weak attitudes about the way pigs are raised. They did have some concerns about food safety and preferred Chinese breeds over European ones and tastier over leaner meat, but the differences were small. These are the urbanites that not only know little about pig production, but also do not care a lot. The remainder of the sample, however, had clearer views. On the other hand, Cluster 1—the *food safety focused*—were very much concerned about safety issues in pig production, much more so than the other respondents. Cluster 3—the *industrial production oriented*—also are concerned about food safety, but at the same time are positive about industrial pig production and quality management resulting in consistent quality.

The incidence of the three clusters showed some geographical variation. Cluster 1 (*food safety focused*) was especially present in Changchun. A recent study (Huang et al. 2010) on consumers of Jilin Province (where the city of Changchun is located) found that when buying pork, consumers that are very concerned or concerned about quality and safety of pork accounted for 88.17 %, while consumers that are a little or not concerned about the quality of pork accounted for only 11.13 %. This may indicate that safety standards of pork products in Changchun are considered lower than in other parts of China. Cluster 2 (*indifferent*) was especially present in Guangzhou (one of the most populated cities of China), but hardly to be found in Changchun. A recent survey on the perception of food safety and willingness to pay for certified traceable food among the citizens of Guangdong Province (where Guangzhou is located) found that 36 % of the respondents are strongly dissatisfied with food safety conditions in the province, but only 37 % of the respondents have heard about the national food traceability system (Xu and Wu 2010). Finally, cluster 3 *(industrial production oriented)* was especially present in Chengdu. The pork production in Sichuan Province (where Chengdu is located) has been ranked first in China for at least 10 years. The Chinese government has always attached great importance to the development of large-scale pig farming industry in Chengdu City, the provincial capital of Sichuan. Driven by the Chengdu Government, 1,000 industrial pig farms with more than 500 sows had been established at the end of 2007, the total investment of which is about 1.1 billion RMB.[1] With preferential policies of the government and the entrance of private capital, many entrepreneurs joined the pig breeding industry. This situation is providing opportunities for the development of specialized, large-scale pig industry in the area, and can help to explain the majority of consumers from Cluster 3 in this city. These pronounced geographical differences underline the considerable heterogeneity in China.

We may further speculate whether the three clusters form stages in a diffusion process. There is a group (*the indifferent cluster*) that is not concerned about the way pigs are produced (stage 1). There is another group (*food safety focused cluster*) that has become concerned about the issue because there is a safety risk involved (stage 2). There is a third group (*industrial production oriented cluster*) that

[1] Data from local news, http://finance.sina.com.cn/china/dfjj/20071025/14564099797.shtml.

also believes that they see the solution to this issue, namely by transforming the value chain from family subsistence production to large-scale industrial production (stage 3). While this interpretation is speculative, it would indicate a correspondence between the development in the attitudes of consumers and the changes that the sector actually goes through. Industrialization is favored by government and pushed by industrial actors, and it is being communicated as a positive development. For example, the big meat processor Shuanghui ran an advertising campaign claiming that their pigs were "raised under modern conditions."

It is interesting to compare these results with those reported by Krystallis et al. (2009) in their study in Europe. Most of their respondents favored small farms and looked with suspicion at large, industrial-size farms. And while also in their studies some favored consistent quality, there was also a segment favoring quality that varies with biological and environmental conditions—as it does in local, artisanal production. Large-scale industrial production does not have a good image in Europe (that probably applies also to other areas than pig production). Apparently, from Chinese consumers' perspective, the industrial approach represents achievement, evolution, quality, and safety, since pig production is moving away from low-cost, family scale systems, where quality inconsistencies and lack of safety assurance were the main problems. The concerns that Western consumers have about large-scale industrial pig production—in terms of environmental impact and animal welfare—seem not to be shared yet by Chinese consumers.

The more positive attitude towards industrialization in food production is also mirrored in the more general attitudes that were measured in this study. Respondents in the *industrial production oriented* cluster had actually more positive attitudes to environmental protection and nature, and more concern about food and the environment. At the same time, they had a more positive attitude towards technological progress. In Europe, these attitudes are usually not positively correlated, and higher concern for the environment does not usually favor attitudes to industrialization and technological progress.

The Chinese food industry is undergoing a massive transformation. In that sense, we share the views of Pingali (2006) and Waldron et al. (2010) and acknowledge that the changes in agriculture and food systems at all levels (production, processing, and distribution/retail) impose a number of important challenges to food safety and food policy, small holder welfare, and agricultural research and development priorities in China. Future research should definitely address those issues, as well as emerging environmental awareness in developing countries.

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Appendix 1: Attitude scale items

Attitude towards environment and nature (Dunlap et al. 2000)

- Humans are severely abusing the environment
- The balance of nature is strong enough to cope with the impacts of modern industrial nations (R)
- The so-called "ecological crisis" facing humankind has been greatly exaggerated (R)
- The earth is like a spaceship with very limited room and resources
- If things continue on their present course, we will soon experience a major ecological catastrophe

Attitude towards technological progress (Hamstra 1991)

- The degree of civilisation can be measured from the degree of technological development
- New technological inventions and applications make up the driving force of progress of society
- In (country) we are probably better off than ever thanks to the tremendous progress in technology
- Throughout the ages, technological know-how has been the most important weapon in the struggle for life
- Because of the development of the technology we will be able to face up to the problems of tomorrow's society

Attitude towards food and environment (Lindeman and Väänänen 2000)

- It is important that the food I eat on a typical day has been prepared in an environmentally friendly way
- It is important that the food I eat on a typical day has been produced in a way which has not shaken the balance of nature
- It is important that the food I eat on a typical day is packaged in an environmentally friendly way

Appendix 2: Pork product items

Fresh first cut

Lean meat

Side pork
Pork ribs
Offal
Trotters

Fresh minimally processed

Ground meat
Meat stuffing
Meatball
Seasoned pork

Further processed

Barbecued pork
Roast pork
Braised pork
Ham sausage

Pork-based dishes

Gravy pork noodles
Meat bun
Pork stuffing dumpling
Pork pie

Pork meat products

Preserved meat
Chinese sausage
Ham
Canned meat
Dried meat floss
Pork jerk

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