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Traceability of meat: Consumers´ associations and their willingness-to-pay

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Abstract— **The willingness-to-pay by German consumers for the credence characteristic traceability of pork and turkey is analysed by means of the conjoint analysis additive model, also taking the consumers´ associations with the term traceability and the QS label into account. The results indicate a different WTP regarding traceability of pork and turkey for specific consumer groups. A majority considers meat traceability as important. However, the distinctive sensitivity to price exhibited is a result of the fact that traceability is only of secondary importance as an assessment criterion, after price. Food retailers should adjust their communication and price policies in order to take advantage of the consumers' higher WTP for traceable products according to the sort of meat.**

Keywords— **conjoint analysis, willingness-to-pay, meat traceability**

I. INTRODUCTION

The objective of this study is to determine the willingness-to-pay (WTP) for traceability of meat (pork and turkey) by German meat consumers. This study is the first using the conjoint analysis additive model and conducting a simulation of the direct buying situation.

The willingness to pay a price premium for traceability is analysed by using labelling on self-service meat packages. The consumers' associations concerning the term traceability and the QS label are examined.

In addition to the intensified discussion over the documentation requirements for agricultural businesses and the food industry that are required to be implemented under the new regulation (EC) No.178/2002, in regard to traceability of food, three questions arise. Firstly, whether consumers are prepared to accept increases in price due to traceability of meat, and whether they are willing to absorb the increased costs of traceability to retailers. Secondly, whether traceability is in itself of value to consumers, and thirdly, whether any additional information is associated with traceability, where in cases it is provided it would in turn lead to increased coordination costs along the meat supply chain. The questions posed focus especially on the understanding of, and communication to consumers.

By means of the results of this study, it is possible to infer implications for the retailers' price and communication policy, with regard to traceable meat and meat products.

II. THEORY

Traceability is a credence characteristic. Consumers can not recognise either before or after the purchase, whether there is a guarantee that the product is actually traceable, and therefore consumers have to trust the labelling information provided by the supplier or retailer. This may have an influence on the WTP for the credence characteristic traceability.

Despite a growing interest in traceability of agricultural products, research up until now has only relatively little examined how consumers understand the need for traceability.

A. The opinion of consumers regarding meat traceability

Previous studies concerning the opinion of consumers regarding meat traceability draw divergent conclusions in different countries.

Due to their heterogeneity, consumers across Europe have divergent associations, perceptions and expectations with regard to traceability. Consumers understand traceability differently for different products [1]. Knowledge on and expectations towards traceability vary in different countries [2].

With respect to traceability characteristics, tracking meat products within the meat supply chain from producer to consumer, focuses on two types of characteristics: namely functional characteristics (such

as organisational efficiency and meat chain monitoring) on the one hand, and process characteristics (such as origin and production methods) on the other. Functional characteristics are linked with the intrinsic opportunities of a traceability system. These characteristics can be regarded as the minimum requirements of a true 'traceability system'. Process characteristics deal with characteristics of the production process at different levels of the chain, i.e. they can be regarded as resulting from extensions of the minimum requirements. The tracking serves as a kind of peg for potential consumer benefits [3].

Consumers in Belgium differ in how strongly they value the necessity of meat traceability. Functional traceability characteristics, such as organisational efficiency, production chain and individual responsibility, are of high importance to Belgian consumers. These traceability characteristics obtain the highest scores on a 7-point scale, compared to process characteristics. Most important is the 'individual responsibility', as well as 'meat chain monitoring'. Organising the chain in a more efficient way is somewhat less important, but still more important than most of the process characteristics. The scores for all the functional characteristics are significantly higher than for the process characteristics. Extensions, with respect to process characteristics such as production methods, are less relevant to Belgian consumers and are only of interest to specific market segments, i.e. consumers with a more negative perception of meat quality and lower consumption levels. There will be a safety rather than a quality orientation [3].

One of the goals of the European Food Law is to restore consumer confidence in food quality and safety, and it is not yet understood whether the implementation of traceability systems can contribute to this goal. On the subject of how consumers perceive the role and potential impact of traceability within the supply chain, little is known up until now [4].

B. Willingness-to-pay regarding meat traceability

Previous studies concerning WTP for traceability of meat arrive at divergent conclusions in different countries with regard to the consumers' understanding of the term "traceability", as well as the acceptance of a price premium for the characteristic traceability. Differences exist, particularly if on the one hand consumers associate traceability simply with meat safety, or if on the other hand they associate it with further information concerning process characteristics and meat quality, thus influencing their WTP. Consequently, WTP for traceable meat depends on the consumers' perception.

Issues related to food safety is of high importance to Spanish consumers, however the majority (72.5 %) of the consumers are not willing to pay an increased price for a certificate for traceability of beef [5]. There are three possible reasons for the reluctance to pay for the increased price: a) Consumers take the safety of the product for granted as a matter of course, and thus are not willing to pay a price premium for it; b) Consumers increasingly have concerns of food products, but not at the levels at which they would be willing to pay extra; and c) In the consumers' opinion, traceability is not sufficient to guarantee food safety. From the results one can conclude that Spanish consumers regard food safety as a basic obligation on behalf of the producers, and thus feel no obligation to pay a price premium for it [5].

The WTP by consumers in the USA, Great Britain, Canada and Japan is higher for traceable meat than for non-traceable meat. The WTP rises further for traceability-provided characteristics (e.g. additional meat safety and humane animal treatment guarantees) [6, 7, 8].

III. METHODOLOGY

For product design, it is essential to know which contributions the different characteristics contribute to the total utility of a product. Through the alteration of a single characteristic, the total utility by consumers can be maximised, and thus increase the consumer demand for a product. In market research, conjoint analysis is used, based on the empirically collected total utility values, to measure the contribution of single characteristics to the total utility [9].

Conjoint analysis provides an analysis of the utility of products, with specific characteristics, resulting for the consumers. This method examines which contribution a specific characteristic, and accordingly the characteristic value of a product, makes to the total utility of the product to consumers. In other words, the

use of a product by consumers is broken into the utility contributions of single product characteristics. With conjoint analysis, it is possible to identify the changes in consumer preferences due to the change of a single specific product characteristic [10].

In this study, the WTP by consumers for traceability is analysed by means of the conjoint analysis additive model. The conjoint analysis additive model is based on the additive composition rule, where it is assumed that individuals just "add up" the values for each characteristic (i.e. the part-worths of the levels) to obtain the total value for a combination of characteristics. Thus, the total utility of any defined stimulus can be calculated as the sum of the parts. On basis of this initial hypothesis, it is possible to determine the relationship of the characteristic price in relation to other product characteristics, and thus deduct information for price policy [9, 11].

By means of the results of conjoint analysis, marketing decisions can be supported in many fields, particularly in product and price policy. With regard to product policy, the use-of-potential analysis, conducted in the context of conjoint analysis, may determine which product characteristic values make a contribution to consumer benefit. Based on this, it comes to a decision about the product redesign as well as the revision of already existing products [10]. With regard to price policy, it is among other things possible by the means of conjoint analysis, to determine the WTP by consumers for a certain increased efficiency (e.g. by quality, service, design) [10].

The data basis of this study is a consumer survey with a sample size of n = 128 in April 2007 in Munich/Germany. The consumer survey took place in a store of a food retailer, in order to represent a fairly realistic buying situation. For the survey, people were chosen who are responsible for the shopping for the household as well as shopping for the meat consumed in the household. The consumers have on average a fairly high level of education and high incomes. Only a small number of families were represented.

For this research, the meat products selected were pork and turkey. The reason behind choosing pork and turkey is that these meat products are in high demand from German consumers. As concerns over BSE could influence the survey and result in an over presentation, beef was not included in this analysis.

In the conjoint analysis, a specific private label, the price, the German "QS label", and a symbol for traceability of packaged pieces of meat were considered as product characteristics. QS is the abbreviation for a quality assurance scheme, covering all stages of the meat supply chain. In the QS system, all companies active in it are working towards a common goal, within the association, of active consumer protection. The QS label and the specific private label which were used were copied from the actual symbols in use. The symbol for traceability of the presented pieces of meat is imaginary and was created by the author for this study.

In the fairly realistic buying situation, realistic meat packages, made available by the food retailer and labelled according to the food retailer's labelling pattern, were shown to the consumers.

The questionnaire is composed of four parts. The first part contains questions as to the frequency of the consumption of pork and turkey, as well as to preferred shopping venues. The use of two conjoint analyses with pork and turkey follows in the second part of the questionnaire. The third part of the questionnaire focuses on questions concerning traceability as well as the QS label, to determine the awareness of the surveyed consumers for these two properties in the case of meat. Socio-demographic data of the consumers are identified in the fourth part of the questionnaire.

For the characteristic 'price', there are three parameter values and for the characteristics 'private label', 'QS label' and 'traceability', there are in each case only two. The parameter values are combined to an orthogonal design of eight products for each meat sort (pork and turkey) [9].

According to the method of ranking order, the consumers were asked to sort each of the eight products for pork as well as each of the eight products for turkey according to their preference. The smaller the ranking score, the higher is the respondent's preference for the particular products [9].

IV. RESULTS

A. Results of conjoint analysis

The conjoint analysis indicates in the case of pork fillets ('Schweineschnitzel') and turkey fillets ('Putenschnitzel'), that the product with the highest total utility is a fillet product of the specific private label, labelled as traceable and with the QS label , which can be obtained for the lowest price. For turkey and pork fillets the price is ranked first, with 37 %. Second ranked is traceability, with approximately 27 %. The specific private label and the QS label play a lesser role (between 17 % and 18 %).

A comparison of the results of both conjoint analyses for pork and turkey fillets shows that the differences between the two sorts of meat are minimal. The rankings, with respect to the importance of the four characteristics price, traceability, the QS label, and private label, are the same for both sorts of meat. The consumers ranked price and the private label as slightly more important for turkey fillets, than as for pork fillets. In contrast, for pork fillets, the property of traceability and the QS label were ranked as more important. However, the differences in the relative importance for the two sorts of meat were at the maximum one percentage point.

B. Willingness-to-pay of several subgroups of the respondents

In order to analyse the WTP of the various subgroups of the consumers in relation to the characteristic traceability, the consumers were divided based on respondent specific variables and separate conjoint analyses were done for these subgroups. Thus, in this manner the WTP by these consumer groups was determined and differences between the groups were identified.

Differentiation of demographic characteristics

The relationship between sex, age, education, profession, income, size of household and number of children of the consumers, and their WTP for traceability of meat was examined.

Specific consumer groups show a WTP for traceability of meat. Thus, male consumers, consumers at the age of 46 to 55, retired people, and consumers with an income of 2,600 to 4,499 €, as well as families with two children, are willing to pay a price premium for the characteristic traceability of pork and turkey. The characteristic traceability is valued more highly by these demographic subgroups than the product price and the other conjoint characteristics.

A WTP for traceability of meat, in relation to the level of education, could not be determined.

In conclusion, the expectation that consumers viewing traceability of meat as necessary are also willing to pay an increased price, is confirmed by this study for both sort of meat. These consumers are roughly 70 % of the sample size. Thus, the characteristic traceability is measured to be of great significance, and that is reflected in the WTP of several subgroups in the survey. In the evaluation of the relative importance of the characteristic traceability, it should be noted that there is a marked emphasis on price orientation for some consumers; therefore traceability in general is only the second most important criterion, after price.

C. Traceability and QS label as viewed by consumers

The consumers´ associations held in relation to the term traceability and the QS label were determined. In regard to the associations held about the two characteristics, different subgroups of consumers were generated and their WTP was evaluated. In this manner the relationship between the consumers´ associations about the characteristics traceability and QS label, and the related WTP of consumers was clarified.

Associations with the term traceability

Approximately a fourth of the consumers have no concept about the term traceability. For the majority of the consumers (74.2 %), the term traceability is not unknown, and at least one response regarding it is made (n = 95). Figure 1 shows the consumers´ associations with the term traceability.

42.11 % of the consumers that offer an association to the term traceability, link traceability of meat specifically with the agricultural producer where the animals are raised. The majority of the consumers that respond regarding traceability also associate the source of the meat, but do not name only the agricultural producer, but also indicate multiple stages

along the meat supply chain (agricultural producer, slaughterhouse, meat cutting plant). 20 % of the consumers respond more expansively to the term traceability, and include information on the country of origin and the region of origin. It is unclear if those consumers mean by this the agricultural producer, or if they mean a further point in the production of meat, such as the location of the slaughterhouse. Only 3.16 % of the consumers specifically mention the slaughterhouse.

22.11 % connect with the term traceability that information on animal husbandry practices should be made available at the time of the meat purchase. In this category is included, for example, information on the animal breed, feeding practices, or organic rearing methods. As this is frequently linked with the association with humane animal treatment (18.95 %), responses regarding species correct rearing practices fall into this specific special category. 24.21 % of consumers responding with associations to traceability link traceability with control and safety, in the case of food safety problems. Quality of meat is associated by 13.68 % of consumers with traceability. Only a few of the consumers (6.32 %) associate with the term traceability regional products, which are linked with shorter transport routes. Shorter transport routes are associated not only with a more environmentally friendly, but also a more animal friendly production chain.

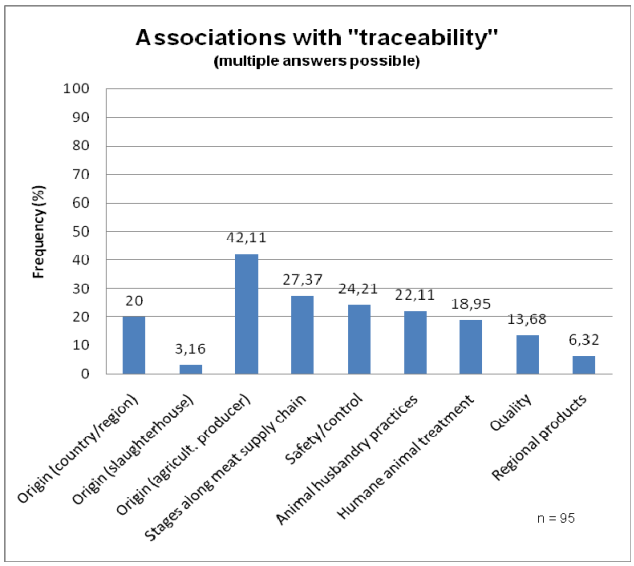

Fig. 1 Associations with traceability

Relationship between WTP and associations with meat traceability

The following presents the relationship between the associations of consumers with the term traceability and the WTP for the characteristic traceability.

The conjoint analysis of turkey fillets indicates that consumers who associate the term traceability with the ability to trace a product back along the meat supply chain, and accordingly, information on the breeding of the animal, or with species correct animal rearing practices, rate traceability as the most important evaluation criterion. Traceability of meat is found to be more important than the price of the product, in other words, they are willing to pay an increased price. Consumers that associate traceability with regional foods and short transport routes also consider the characteristic traceability to be of higher relative importance than price. However, for this group of consumers, the specific private label is the most important evaluation criterion.

The results of the conjoint analysis confirm that in the case of pork fillets, for consumers that associate traceability with the ability to trace a product along the meat supply chain, and accordingly information on animal breeding, or species correct animal rearing methods, the characteristic traceability is the main evaluation criterion. In addition, consumers that associate traceability with the region view this as the most important characteristic for pork fillets. The private label is viewed by this group as the second most important evaluation criterion.

Consumers that associate with traceability the origin, safety, or quality, view the product price, for both pork and turkey fillets, to be the most important evaluation criterion.

Associations with the QS label

In addition to their associations with the traceability of meat, consumers were also asked about their associations with the QS label. The consumers´ responses on the subject of QS label are presented in the following subparagraph.

Almost half of the consumers respond to the question over the recognition of the QS label with a “Yes”. The other half of the consumers responds that they had never seen it before. Only 28.1 % of the consumers consider the QS label to be necessary.

61.7 % of the consumers characterized this as unnecessary and 10.2 % answer the question with regard to the necessity of the QS label with "do not know".

When questioned over associations with the QS label, the majority of those questioned offer no associations (61.7 %). 38.3 % (n = 49) of those questioned give at least one association. Figure 2 shows the consumers´ associations with the QS label. The larger portion of those questioned view the QS label as a quality mark, and link to the quality of the product (83,67 %). 28.57 % of those questioned, that give their associations in regards to the QS label, associate it with the control, or rather with the monitoring by an inspection authority. For another portion of the consumers that offer a response, the QS label is associated with safety (20.41 %). For 12.24 % of the consumers, that offer associations with the QS label, they associate it with the origin of the meat, in other words with the region of origin. 4.08 % of those questioned associated the QS label with the freshness of the product.

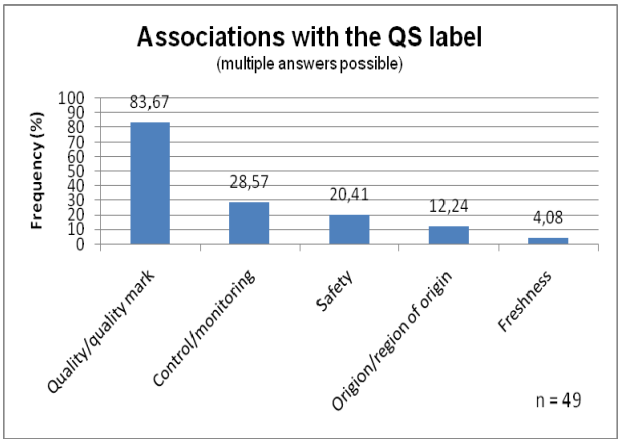

Fig. 2 Associations with the QS label

Relationship between associations with the QS label and the consumers´ WTP

In the following section it will be examined if there is a relationship between the consumers´ associations with the QS label, and the WTP for the two characteristics, namely traceability and the QS label.

The results of both conjoint analyses demonstrate that none of the groups that offer associations regarding the QS label place the highest value on this characteristic during the product evaluation. Thus, a WTP for the QS label could not be determined for these groups. Even though consumers have associations over this specific label, they are not willing to pay a price premium for it.

However, consumers that view the QS label as a mark of quality, and accordingly connect it with monitoring, inspection or safety, indicate that they were willing to pay for the characteristic traceability.

The two remaining groups, that associate the QS label with the origin of the product, link it with the region, or associate it with freshness, evaluate the price first during the product evaluation. The greatest relative importance of the QS label occurs with consumers that associate it with freshness; however they show no WTP for the specific label.

Relationship between associations regarding the QS symbol and regarding meat traceability

In the following section the relationship between the associations of the consumers over the QS label and their associations with the term traceability are presented. The responses of the consumers to these two characteristics are based on the total number of the responses (n = 123), that were made simultaneously in regards to traceability and the QS label.

The majority of the consumers associate the QS label with quality or rather view it as a quality mark, and also associate traceability with the agricultural producer (12.20 %). Furthermore, consumers more commonly view traceability as an indication of safety and the QS label as a quality symbol (9.76 %). Consumers also commonly associate the QS label with a quality mark and traceability with the ability to trace the product through the entire supply chain (8.94 %). In 5.69 % of the cases, consumers view the QS label as a quality mark and traceability as an indication of the country of origin, or the region of origin. In addition, in 5.69 % of the cases, consumers associate the QS label with a quality mark and traceability with information on the rearing of the animal, or rather the quality. Similarly, 5.69 % of the consumers´ responses implicate control and monitoring (with regard to the QS label) with traceability as an indicator for the agricultural producer.

In roughly 5 % of the cases, consumers associate traceability with species correct rearing methods and the QS label with a quality mark. Further, in 4 % of the responses, consumers associate the QS label with safety, and traceability with the tracing of the product along the supply chain, with respect to safety. Roughly 2.5 % of the responses hold an association between monitoring with regard to the QS label, as well as the country of origin and species correct animal rearing methods with regard to traceability. In 1.63 % of the cases, consumers link the QS label with monitoring and traceability with safety or information concerning the rearing of the animals. Next to the aspects of origin and regional products associated with the QS label, the associations named for traceability consist primarily of the region or country of origin, information on species correct rearing practices, or species correct rearing methods (2.44 %). As an equivalent to the association of safety with the QS label, consumers view traceability primarily as the ability to trace the product through the supply chain, or species correct rearing methods (4.07 %).

V. DISCUSSION AND CONCLUSION

The results show that German consumers relate traceability to more than only a labelling of origin. Those consumers which also associate traceability of meat with several production procedures and humane animal treatment are willing to pay a price premium for traceability of meat.

The results of this data collection provide evidence that specific consumer groups show a WTP for traceability of meat. Thus, male consumers, consumers at the age of 46 to 55, retired people, and consumers with an income of 2,600 to 4,499 €, as well as families with two children, are willing to pay a price premium for the characteristic traceability of pork and turkey. The characteristic traceability is valued more highly by these demographic subgroups than the product price and the other conjoint characteristics. The majority of interviewed consumers consider traceability of meat as necessary. However, the results of the conjoint analyses show in the case of pork, as well as in the case of turkey, that the price of meat is still of great importance. The distinctive sensitivity to price exhibited by many of those interviewed is a result of the fact that for both sorts of meat, traceability is only of secondary importance as an assessment criterion after price, but before the criterion 'QS label', and the specific private label. The comparison of the results of both conjoint analyses for pork and turkey indicates that there is not much of a difference between both sorts of meat.

However, within the scope of this study, the issue of appropriate information as a conjoint characteristic is not addressed. It would be advisable to clarify if the integration of further information in the traceability system would result in a higher WTP from the remaining consumers, which currently do not associate traceability with this information. It is to be recommended that in further studies on the consumers' WTP additional information should be included in order to analyse their significance. Thus, food retailers could more effectively and more precisely modify their price and communication policy to maximise the WTP on the part of consumers.

In conclusion, German consumers have different associations concerning traceability, and this has an impact on their WTP for traceable meat. The majority of interviewed consumers consider traceability of meat as necessary. However, the associations that consumers have in regard to traceability, and their information requirements, should also be considered when analysing the WTP by German consumers.

By means of the results of this empirical study, food retailers may adjust their communication and price policies, in order to take advantage of the consumers' higher WTP for traceable products, according to the sort of meat. Traceable products need to be labelled clearly so that consumers can accurately identify these products. Appropriate product labelling should clearly communicate traceability of the product, as well as clarify the definition of traceability.

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