Berlin Consumer Preferences for Quality Attributes of Fresh Vegetables

Yue Lai, Wojciech J. Florkowski, Bernhard Brückner, and Ilona Schonhof

The purpose of this study is to investigate consumer preferences for quality attributes of fresh vegetables. The geographical scope of the study is the metropolitan area of Berlin, Germany. The influence of socio-economic and demographic characteristics on preferences is explored within the conceptual framework of utility maximization. The study results provide insights about Berlin consumers' demand for quality attributes of fresh vegetables and can be used by the fresh produce industry in making production, marketing, and export decisions.

Profit incentives and the competitiveness of the U.S. domestic produce market have forced retailers and marketers to explore marketing opportunities abroad. Produce export has become an important marketing strategy for the fresh produce industry (Handy, 1990). Demand for fresh vegetables from the U.S. has been strong (Anonymous, 1992; Brennan, 1995). However, the U.S. exports of fresh vegetables to Germany have been negligible. Marketing produce abroad requires knowledge of a foreign market including consumer preferences for produce quality attributes. This study helps to improve the knowledge about quality preferences of Berlin residents.

By identifying the preferred quality attributes both the U.S. and German growers, distributors and retailers can cooperate in assuring the steady supply of fresh vegetables meeting customers' expectations. Southern regions of the United States are characterized by a growing season complementing the seasonal production of vegetables in Germany. Many temperate zone vegetables can be grown during the fall-spring period in the southeastern states leaving the opportunity to grow produce during the late spring-early fall for German farmers. Consequently, consumers may be able to purchase a wide variety of fresh vegetables throughout the year, while growers, distributors, and retailers can earn additional income.

Y. Lai is Postdoctoral Associate, and W. J. Florkowski is Associate Professor in the Dept. of Ag. & Applied Economics at the University of Georgia, Griffin, GA. Both B. Brückner and I. Schonhof are Scientists at the Institute fuer Gemuese und Zierpflanzenbau, Grossbeeren, Germany.

Geographical Scope

Germany is a net importer of fresh vegetables. Prior to the unification of both German states, The Federal Republic of Germany was 68.9 percent self-sufficient in its vegetable production (Hinton, 1991). Since the unification, the degree of self-sufficiency changed little and Germany continues to import fresh vegetables. The continuation of imports is supported by the relatively low per capita consumption given the level of per capita income. The per capita consumption of vegetables in the western part of Germany, in the mid-1980s, was 8.8 kilograms and 15.5 kilograms, respectively, lower than in United Kingdom or Belgium. Because the consumption of vegetables seems to be lagging behind the available incomes, German market offers particular opportunities for vegetable growers. The United States has been virtually absent on the German vegetable market and exported 17 metric tons of vegetables in 1987.

Demand for fresh vegetables is particularly strong in densely populated areas. In industrialized countries such areas are characterized by relatively high incomes because the labor is skilled and well educated. For the purpose of this study, we selected Berlin because this is a rapidly growing metropolis of 3.5 million residents. The growth, stimulated by the transfer of the federal government from Bonn to Berlin, assures the inflow of new, highly educated residents with mid- to high income levels. Earlier studies of food demand indicated that as incomes grew, the pattern of expenditures by food categories changed, and the share of expenditures on produce increased. The trend toward increasing shares of produce in consumer food expenditures, the relatively low vegetable consumption in the country, and the strongly growing economy of Berlin strengthen the potential demand for fresh vegetables and justify the geographical focus of this study.

Quality Attributes

The fresh vegetable market trades in perishables. Therefore, the efforts of growers and distributors focus on maintaining marketable quality and the extension of shelf life. Vegetables with longer shelf life can be transported over long distances, but many vegetables are very sensitive to handling and transportation. Leafy vegetables in particular can sustain damage from poor handling or temporary storage in suboptimal conditions. Fresh vegetables are living organisms and the large leaf surface accelerates transpiration unless the storage area assures temperature and humidity control. Some vegetables are sensitive to the by-products of metabolism. For example, the content of carbon dioxide in the storage facility without proper ventilation can induce and accelerate quality changes. Inadequate attention to handling, storage, transportation, and display of fresh vegetables leads to the deterioration of quality attributes. However, technology exists to minimize quality loss.

Among the most important attributes of vegetables is their fresh appearance. The overall appearance or condition is assessed visually by customers at the point of purchase. Indication of freshness includes several measures. Wilting is a good measure of freshness, but its symptoms vary across various types of vegetables. Limp stems, dull leaf surface, and dryness indicate wilting leafy vegetables, but these measures may not be adequate or appropriate for evaluating the freshness of root vegetables. Customers develop their skills of quality evaluation through a trial and error process and broaden their assessment measures. More refined measures of quality assessment include color, firmness (if allowed to touch the produce), size, and tapping sometimes on the surface.

Attributes include physical attributes which are visible to a buyer (e.g., size, the presence of foreign matter, mechanical damage). The separate group of attributes describes intrinsic quality attributes such as juiciness, internal bruises or rot, and off-flavor. These attributes become apparent during the actual eating or can be measured only on a sample subject to destructive testing. Assuming that freshness is necessary to successfully market fresh vegetables, it is essential to learn what are other important attributes that influence purchase. Price for a unit of fresh vegetables is an economic attribute which is weighted against a construct synthesizing all quality attributes assessed by individual customers. Mechanical damage resulting from improper handling, packaging, or transportation represents a loss of value to customers because it causes waste during preparation and requires additional time and effort prior to eating. Price and visible damage are important to the fresh vegetable industry. Both attributes are directly related to production and export decisions.

Data

The information about preferences for fresh vegetable quality attributes is anecdotal because no systematic observations based on a large sample of customers are known to exist. The combination of experience and current observations provides some indication of what customers demand, but such knowledge is rarely shared with others within the country. It is even less accessible to overseas growers and companies. To provide insights about quality preferences among Berlin residents it was necessary to design and implement a survey.

The implementation of the survey created a source of previously unavailable information. In order to assure the practical relevance of this information, the sample of surveyed consumers was carefully selected from among Berlin residents. The sample's profile was based on the income distribution of all residents, but the potential respondents were drawn from the population of six administrative districts. The districts represented high, middle, and low income areas.

The survey instrument was drafted in English. The process of survey instrument design included the translation into German. The translation poses problems of accuracy concerning the presentation of issues and the list of answers which may be selected by respondents. The knowledge of cultural differences, habits, and traditions is invaluable and prevents miscommunication.

The effectiveness of communication was essential because the survey was self-administered. The cost of implementing the survey prevented personal interviews and encouraged the use of mail as a medium of questionnaire dissemination. Prior to mailing, a pilot test of the questionnaire was applied to eliminate any overlooked areas of

Table 1. Importance of Quality Attributes of Fresh Vegetables.

Quality attribute	Strongly agree	Agree	Neither agree nor disagree	Disagree	Don't know
Freshness[a]	78.6	21.0	0.2	0	0.2
Minimal chemical residue	65.1	22.7	2.6	2.1	7.5
Taste as expected	31.7	59.0	7.4	1.4	0.6
No damage	33.3	50.0	11.9	4.0	0.8
Reasonably priced	38.8	51.9	7.4	0.6	1.2

[a] From Florkowski, Brückner and Schonhof, 1996, Table 1, p. 137.

the questionnaire which could lead to misinterpretation of questions. The results of the pilot test suggested good preparation of the survey instrument. A survey was conducted in Berlin in the late 1994 to gather information on consumer attitudes towards and perceptions of fresh vegetables. The sample closely resembled the general demographic, income, and educational profile of Berlin residents. Of the 2,773 questionnaires mailed, 525 responses were received after a single mailing. The response rate of 18.9% was considered adequate given the large sample size.

In the survey, respondents were asked to evaluate the importance of quality attributes of fresh vegetables. The list of possible answers ranged from "disagree" to "strongly agree." Few responses fell into categories indicating any disagreement, therefore, these choices were excluded from further modeling.

The clear preference for freshness expressed by 99.6 percent of respondents (Table 1) has been already investigated (Florkowski et al., 1996). The message is unmistakable and confirms that Berlin residents commonly appraise this attribute. About the same number of respondents perceived the remaining four attributes as important, but the distribution across the possible response categories varied more than in the case of freshness. Nearly two-thirds of the respondents "strongly agreed" that fresh vegetables should contain the least chemical residue. More than eight percent did not understand the importance or unimportance of this attribute, the highest proportion in comparison to other attributes listed in Table 1. A chemical residue issue is important to German consumers, but it can be only assured by government agency, the EU agency, growers' association, or an agribusiness organization. In general, a party that issues the assurance is not directly accountable to consumers.

Consumers' experience in eating fresh vegetables shaped expectations of taste. Preferences reflected the anticipation of pleasure during eating and influenced the purchase decision. More than 90 percent of participants "strongly agreed" or "agreed" that this attribute is important. The taste of fresh vegetables identified during the act of consumption, can be assessed at the time of purchase only through indirect measures. Such measures include visible attributes (for example, the color) which provide hints about the potential taste, but do not guarantee it. The distinction between visible and intrinsic quality attributes of food products implies the need for separate investigations because consumers are only in the position to form an opinion based on attributes they can verify. In this study, price and visible damage have been selected for further analysis because they can be evaluated by customers prior to concluding a purchase.

Among physical attributes, the absence of damage was important to 83.3 percent of respondents, although almost 16 percent suggested otherwise. Any visible damage sends an immediate signal to consumers and shapes the decision to purchase. Because of the damage effect on the purchase, the identification of factors influencing the perceived importance of this attribute is vital. The probability of the occurrence of damage is directly related to the number of produce handling points. In this sense, domestic growers may have an advantage over overseas producers because the physical distance from the field to the market is short. However, the available technology and the coordination of shipping allow to reduce the potential for damage in long distance shipping.

The perception of reasonable price was important to most of responding Berliners; 38.8 percent "strongly agreed" and 51.9 percent "agreed" that "a reasonable price" was an important attribute influencing the purchase. The potential of ex-

porting fresh vegetables to the Berlin market can be realized, if the price paid by consumers will assure profits for all links in the distribution channel. Although attributes other than the price were selected more often, to assure the sizable and sustained demand for fresh vegetables, price deserves special attention. Knowledge of consumer characteristics influencing the importance of fresh vegetable price is of practical value to the produce sector.

Modeling Procedure

Empirical studies of consumer behavior are frequently based on the utility maximization framework (Greene, 1993). In this study, Berlin consumers are assumed to maximize utility from consuming fresh vegetables with specific quality attributes. The purchase is influenced by the good's attributes. By indicating the intensity of agreement regarding the importance of an attribute, respondents signaled the expected utility of their choice. The intensity of agreement, measured along an ordinal scale, is the demonstration of the unobservable, individually defined utility.

A probit approach is applied to identify statistically significant characteristics of consumers and their influence on preferences for two attributes. The selection of explanatory variables is based on earlier empirical studies of preferences for quality attributes. Demographic and socioeconomic characteristics have been commonly found to relate to variations in consumer preferences, attitudes and perceptions (Ott et al., 1991; Byrne et al., 1994; Underhill et al., 1996). In addition, the purchase behavior and the attitude factors were included in the specified relationships. Specifically, it was hypothesized that the role in meal preparation could influence the perception of quality attribute importance. Moreover, the attitude toward the survey topic reflected the importance respondents attached to fresh produce consumption.

The empirical relationship, estimated using the probit approach, is formulated as follows:

> The intensity of agreement = f (gender, age, household income, number of children/adults in the household, employment status, education level, role in meal preparation, attitude towards survey);

where the binary dependent variable indicates whether the respondent "agreed" or "strongly agreed" with the importance of quality attribute of fresh vegetables. The majority of the respondents agreed that the two attributes are important in fresh vegetables, but varied in the intensity of their agreement. Variations in agreeing about the importance of quality attributes of fresh vegetables will help identify consumer characteristics which could aid producers and marketers in choosing their production and marketing decisions. All variables in the specified empirical relationships are binary, except the variable describing the attitude of the respondent toward the survey's subject.

Results

The results of probit analysis are given in Table 2. The chi-squared test results showed the reasonable fit of the specified relationships. However, the specific results varied and suggest a better fit of the equation portraying the "reasonable price." The equation representing the preference for "no damage" might have omitted relevant factors.

Reasonable Price

Income proved a relevant variable helping to distinguish between those who "strongly agreed" rather than "agreed" that a "reasonable price" influences the purchase decision. Berlin residents from the highest income category were less likely to consider this attribute as important than middle income respondents. Although the sign of the lowest income variable had the negative sign as in the case of the middle income category, it was not statistically significant. The higher the number of adults in the household, the less concern about reasonable price of fresh vegetables and its potential influence on the purchasing decision. It is possible that when there are more adults in the household, the total household income may be larger; adults may earn income or receive individual fixed transfers from pension funds or social security agency. Florkowski et al. (1996) showed that the importance of freshness as an attribute was positively related to the number of adults in the household.

Table 2. Results of Probit Estimation for Two Attributes of Fresh Vegetables.

Variable name	Variable definition	Reasonable price	No damage
Constant		-1.36[d]	0.01
Female	Gender: 1=female; 0=male;	0.21	0.09
Income 1	Income[a]: 1=income 1; 0 otherwise;	-0.15	0.04
Income 2	Income[a]: 1=income 2; 0 otherwise;	-0.37[e]	0.30[f]
Children	Number of children in household;[b]	-0.09	-0.02
Adult	Number of adults in household;[c]	-0.19[f]	0.03
Employed	Employment status: 1=employed; 0 otherwise;	0.32[f]	-0.12
Student	1=student; 0 otherwise;	0.17	-0.76[e]
College	1=college; 0 otherwise;	0.06	-0.11
Meal Preparer	Respondent was the primary meal preparer=1; 0 otherwise;	-0.01	0.24
Importance	Ordinal scale ranging from 1 to 10;	0.15[d]	-0.08[e]
^{2}	Statistics from the likelihood ratio test.	30.97[d]	16.39[e]

[a] Income 1 = less than or equal to 1800 DM/month; Income 2 = 1801-4000 DM/month; and Income 3 = more than 4000 DM/month. [b] 18 years old or younger. [c] Older than 18. [d] Significant at = 0.01 [e] Significant at = 0.05 [f] Significant at = 0.10

Respondents classifying themselves as "employed" were more concerned with the price than those not employed. The perception of "reasonable price" by the working respondents may have been influenced by factors not included in the specified relationship. Employment generates income, but may also redefine prices in terms of the received wage rates. Student respondents also were concerned with the price of fresh vegetables and its influence on the purchase decision, but the coefficient was not significant.

Finally, the attitude toward the survey matter positively influenced the importance of vegetable price. The more importance respondents attached to issues of produce consumption, attributes, shopping, the more likely were they to consider price prior to the purchase decision.

No Damage

The damage to fresh vegetables resulting from harvesting or postharvest handling can be visually evaluated by customers at the point of purchase. Results indicate who is more likely to perceive the presence of damage as important factor influencing the purchase decision. Those who were students expressed less concern with the damage than those not employed. Students are generally younger and less experienced shoppers and may attach more importance to other attributes. Students tend to spend less time cooking, their households are generally small, and, as a result, they purchase fresh vegetables infrequently or in small quantities which lowers the probability of buying damaged produce. Respondents for whom the topic of the survey was important, were also less concerned with the visible damage of fresh vegetables. Perhaps the importance of the survey topic reflected their attitude toward eating produce in general, and they were able to deal with the incidents of buying damaged produce or were carefully examining produce prior to purchase.

Respondents with the middle level of incomes were more likely to perceive the lack of damage as important in comparison to the highest income level group. The middle income group is the largest group of customers and likely drives the demand for produce. The retail industry may place priority on meeting expectations of this group because of its importance in generating sales. The presence of damage has other consequences than just influencing the visual appeal of fresh vegetables. Damage may invite diseases and help in spreading them in an otherwise healthy batch of produce.

Although the remaining variables proved to be statistically insignificant, the signs of the estimated coefficients provide some indication about the possible importance of damage. Primary meal preparers and female respondents attached more importance to the absence of damage than secondary meal preparers and males. Employed, college graduate, and households with children attached less importance to the presence of damage than their counterparts. These indications must be treated with caution, because they were not con-

firmed statistically, although they may be intuitively correct. For example, females tend to shop for produce more often than men and assume the role of primary meal preparer; the presence of vegetable damage could extend time needed to prepare a meal and increase the amount of waste. Those employed may value convenience more than the absence of damage, and could have been willing to accept the damage if this meant saving time. The higher educated may have displayed more flexibility in handling damaged vegetables which less educated respondents were lacking.

Discussion

Quality attributes of fresh vegetables are important to consumers because they affect their purchase decisions. Based on the response summary, this study found that Berlin respondents considered freshness, minimal amount of chemical residue, reasonable prices, the absence of damage, and taste the primary quality attributes fresh vegetables. Freshness was an overwhelmingly expected attribute by Berlin respondents (Florkowski et al., 1996). The remaining four attributes were divided into visible and intrinsic attributes. Only visible attributes, including the price and the presence or absence of damage, were addressed by this study. The intrinsic attributes could affect the repeated purchases of the same kind of vegetables and are relevant to the purchases at the same outlet. From the standpoint of the selection of a fresh vegetable, price perceptions, and the absence of damage are important. Both attributes are controlled by growers, handlers, and retailers who can actually adjust their decisions and behavior to meet expectations of various groups of customers.

Probit estimation results indicate the varying importance of socio-economic, demographic, and opinion variables regarding the influence of two attributes on purchasing decision. The design of marketing campaigns for fresh vegetables may take consumers' demographic and socio-economic characteristics into consideration. Consumers with higher incomes considered appearance such as "no damage" as more important while the price factor as less important. Therefore, marketing of fresh vegetables without damage to middle-income consumers may generate greater profits. The absence of visible damage is understood by the vegetable industry. However, the protection of vegetables from internal damage resulting from harvesting techniques, short term storage, transportation, and handling is less obvious. Internal defects become evident at the consumer's household, and rarely are they communicated to retailers and transmitted down the marketing chain. Consumers may change their shopping frequency at the outlet they purchased internally damaged vegetable, but this change will not be known by retailers and may not affect the total volume sold. The attention to visible damage is essential, but future studies must address the importance of internal damage and its influence of the purchase decision.

Exporters must recognize that Berliners with middle incomes, the main group of vegetable buyers, may be less concerned with the price, but find damaged vegetables unacceptable. The discovery of less concern about "reasonable prices" of fresh vegetables is encouraging a closer look at the potential of the Berlin produce market. For the U.S.-based exporters, the market could be attractive primarily during the late fall/early spring season when fresh vegetable imports by Germany increase. Some of the most frequently eaten vegetables by the respondents included carrots, green peppers, and onions which can be produced in the Southeast. Other vegetables preferred by Berlin consumers, e.g. leeks, are less known to growers, but may be grown if the export opportunities develop.

This study was intended to provide insight about preferences of consumers and must be followed by additional research. Future research should focus on refining the knowledge of Berlin consumer preferences for fresh vegetable attributes. The new emphasis on organic production, encouraged by the EU, may require changes in production practices of both German and U.S. farmers. Other production and postharvest technologies may become available, lowering the transportation and handling costs. A study addressing transportation costs from the Southeast to Berlin will be a natural step toward providing crucial information for the formulation of the geographic orientation of fresh vegetable marketing.

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