Determinants of Consumers' Purchase Decision

For Maine Round White Potatoes*

by

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Abstract

Potatoes are marketed by type (i.e. round white, russet, red, etc.), rather than by variety. However, the round white varieties currently marketed by the Maine potato industry are known to differ considerably in terms of product characteristics. This study was designed to test the hypothesis that consumer acceptance of potatoes in home use varies by variety and to quantify how their level of acceptance and other characteristics impact their repurchase decision. A discrete choice model was used. The results indicated that consumers do differentiate round white potato varieties based on the performance of the potatoes in home use. Their willingness to repurchase the round white potatoes is affected by the variety used and the overall serving quality of the potatoes in home use.

Introduction

Over the last two decades the Maine potato industry has faced increasingly stiff competition and experienced a significant decrease in its production, revenues, and market shares.

Western suppliers have gained substantial market share in the major eastern markets (National Food Review 1986). Furthermore, market penetration in the Northeast region by Idaho alone increased from 13 percent in 1975 to over 23 percent in 1986. Canada has also been extremely effective in entering northeastern markets and has captured approximately 11 percent of the Boston market.

The results of the Annual Fresh Trends Survey conducted by *The Packer* show that consumers consider russet potatoes to be one of the most quality-consistent fresh vegetables they buy (King and Zind, 1987). To some extent this consistency is attributable to the historic marketing of a predominant variety, the Russet Burbank. In comparison, the production and marketing of round whites is considerably different. In Maine, the supply of round whites marketed for tablestock consists of more than six different major varieties, as well as a number of minor varieties. These varieties are known to differ considerably in terms of their production characteristics. Equally important, the first market test conducted in 1988 with four round white varieties illustrated that some varieties also vary in terms of culinary characteristics and that consumers are sensitive to these discrepancies (Kezis, Smith, Peavey and Lloyd, 1988).

In an effort to regain markets, the Maine potato industry has directed efforts toward improving its marketing practices, with particular attention on its quality image and consumer satisfaction. This analysis is part of an on-going study, first reported on in 1988, that is being conducted to provide the industry with a better understanding of consumer behavior and to help identify appropriate varieties for further marketing emphasis.

The objective of this study is to determine if consumer acceptance of potatoes in home use varies by variety and to quantify how their level of acceptance and other characteristics impact their repurchase decision. Previous studies on potato consumption have focused on price effects and impacts of socioeconomic factors, and treated all types of potatoes as a homogeneous product (Capps and Love 1983, Cox, Ziemer, and Chavas 1984). The effects of potato type, packaging, potato origin and terminal potato market, and the level of potato stocks on price have also been investigated (Goodwin, Fuller, Capps, and Asgill 1988; McRae, Fleming, and Fisher 1984). However, little work addressing the effect of potato varieties on the consumer's repurchase decision is available.

Five round white varieties were selected for testing: the FL657, Sunrise, Superior, CS7635-4, and the CS7697-24. The FL657 is a variety currently gaining in producer acceptance that performed especially well in 1988 market tests. The Superior is one of the favored varieties marketed through tablestock channels by Maine producers. The CS7635-4 and CS7967-24 are varieties being considered for general release through the University of Maine potato breeding program. The Sunrise is a particularly attractive potato which was previously released from the breeding program for which only limited consumer acceptance information exists.

The Data

A short questionnaire was used to obtain needed consumer responses. It was printed on a two-color postage paid card and consisted of twelve questions pertaining to why the consumer had purchased the product, how the product was used, and how suitable the potatoes were for different preparations. In addition, consumers were asked to list any complaints, to compare the potatoes to their usual purchase, and to state whether or not they would purchase the same potatoes again, if available. Respondents were also asked to provide basic demographic information such as household income, household size, age and sex of the respondents. The questionnaire and a colorful recipe insert were placed in a heat sealed clear plastic package.

The different varieties were separated, sized 2 1/4" to 3 1/2", washed and packed into five pound poly bags labeled Maine Round White, Premium Potatoes, U.S. No.1. The questionnaire package, which included a code to identify the specific variety, was inserted in each five pound bag. In winter 1989, a total of

26,625 bags containing the five varieties were shipped through normal market channels to a major New England supermarket chain, and then sold at an identical competitive price throughout the stores.

A total of 969 questionnaires were returned. This analysis includes data from 736 usable responses reporting complete relevant information. The distribution of responses among the five varieties are: 38.1 percent of returns corresponded to the FL657, 13.7 percent and 12.5 percent were from those who had purchased the CS7635-4 and the CS7697-24, and the respondents who had purchased the Sunrise and the Superior accounted for 17.8 percent of the sample each.

In this study, the respondents were assumed to be the person responsible for food purchasing and represented the consensus of the household. Over 39.6 percent of the respondents were under the ages of 45, 36.4 percent were between 45-64, and 24 percent were 65 years or older. Furthermore, 29 percent of the respondents had an annual household income of less than $20,000, 48.9 percent were between $20,000 and $50,000, and 22.1 percent reported an income of $50,000 or more. Over 90 percent of the respondents stated that they would be willing to continue purchasing the same type of round white potatoes, if available; and about 85 percent indicated that the price of these potatoes was reasonable. Of the 736 respondents, 15.8 percent named Idaho russet as the only type of potato they usually purchased.

The major portion of the survey was designed to obtain information on consumers' level of satisfaction with the potatoes used for specific preparation categories of boiled, mashed, baked, fried, and other methods (Table 1). Baked potatoes were served most often, followed by mashed and boiled. Respondents were less likely to prepare fried potatoes and only a few used the potatoes in salads, casseroles, and chowders. In each method, a clear majority rated the potatoes as good or excellent, indicating that the potatoes are suitable for a variety of cooking methods. Moreover, the potatoes received higher overall ratings when served as mashed potato comparing to other preparation methods.

The Model

A probabilistic-choice probit model was specified and estimated for purposes of determining the effect of selected variables on consumers repurchase decision for Maine round white potatoes. A binary dependent variable was specified in accordance with the respondents' reported willingness to purchase the product again. Assuming that there exists an underlying response variable y_i^*, the probit model for this study is given by:

$$Y_i^* = \beta_0 + \beta_1 CS1_i + \beta_2 CS2_i + \beta_3 SUN_i \\ + \beta_4 SUPR_i + \beta_5 SQ_i + \beta_6 ID_i \\ + \beta_7 AGE1_i + \beta_8 AGE2_i + \beta_9 INC1_i \\ + \beta_{10} INC2_i + e_i \quad (1)$$

and, $PURH_i = 1$ if $Y_i^* > 0$; the respondent reported willingness to purchase again.

$= 0$ otherwise.

The explanatory variables can be classified into the following five categories: (1) variety used (CS1, CS2, SUN, and SUPR), (2) serving quality of the product used (SQ), (3) type of potatoes the consumer typically purchases (ID); (4) age of the respondent (AGE1 and AGE2), and (5) household annual income (INC1 and INC2). The description of these variables is given in Table 2.

Since consumer acceptance of potatoes may be affected by variety used, four binary variables were defined for the five varieties: FL657, CS7635-4, CS7697-24, Sunrise, and Superior. The FL657 served as the base (or omitted) category. Consumers rated the potatoes as poor, fair, good, or excellent for each preparation used. These were coded as scores ranging from one for poor to four for excellent. As a measure of serving quality an average score was calculated using the composite consumer ratings of potatoes when boiled, baked, mashed, or fried.

Table 1

Respondent Evaluations For Test Potatoes by Methods of Preparations

	FL657	CS7635-4	SUNRISE	SUPERIOR	CS7697-24
Boil	**159**	**56**	**77**	**86**	**51**
			percent		
Poor-Fair	3.1	5.4	2.6	2.3	7.8
Good	43.4	50.0	44.2	54.7	39.2
Excellent	53.5	44.6	53.2	43.0	52.9
Mash	**205**	**68**	**100**	**98**	**62**
			percent		
Poor-Fair	2.0	0.0	1.0	3.1	6.5
Good	38.0	42.6	44.0	38.8	33.9
Excellent	60.0	57.4	55.0	58.2	59.7
Bake	**216**	**69**	**108**	**99**	**74**
			percent		
Poor-Fair	6.9	11.6	10.2	6.1	5.4
Good	43.1	44.9	42.6	46.5	40.5
Excellent	50.0	43.5	47.2	47.5	54.1
Fry	**64**	**26**	**31**	**30**	**21**
			percent		
Poor-Fair	1.6	3.8	3.2	3.3	0.0
Good	39.1	50.0	45.2	40.0	52.4
Excellent	59.4	46.2	51.6	56.7	47.6

Table 2

Listing of Explanatory Variables

Variable	Variable Name	Description
Variety	CS1	=1 if variety used is CS7635-4
	CS2	=1 if variety used is CS7697-24
	SUN	=1 if variety used is Sunrise
	SUPR	=1 if variety used is Superior
		FL657 is the omitted category
Serving Quality	SQ	An average composite rating of serving quality ranging from 1 for poor and 4 for excellent
Usually	ID	= 1 if usually buy Idaho russet Purchase only
		= 0 otherwise.
Age	AGE1	= 1 if the respondent is 45 to 64 years of age,
	AGE2	= 1 if the respondent is over 64 years of age,
		Omitted category: less than 45 years old
Income	INC1	= 1 if annual household income between $20,000-$49,999
	INC2	= 1 if annual household income equals or above $50,000
		Omitted category: annual household income less than $20,000.

The type of potatoes typically purchased by the respondents was included in the model to account for possible consumer loyalty to any one particular type, which may influence their willingness to purchase the potatoes considered in the study. Two groups of consumers of interest in this study are those who typically purchase Idaho russets and those who typically buy other types of potatoes. Age and income of the respondents are included in the model to account for possible differences in consumer preferences and tastes.

The estimation technique for the probit model is maximum likelihood (Amemiya, Pindyck and Rubinfeld). The maximum likelihood estimates are consistent and asymptotically normally distributed. Consequently, conventional tests of significance and likelihood ratio tests are applicable.

Empirical Results

The maximum likelihood estimates for the model as previously specified are presented in Table 3. The predicted value of the underlying response variable Y_i^* can be used to obtain the probability of repurchasing Maine round white potatoes by calculating the value of standard normal cumulative distribution function, $F(Y_i^*)$. The partial effect of changes in explanatory variables on the probability of repurchasing are shown under the column heading "change in probability" in Table 3.

The respondents who purchased the CS7697-24 and the Sunrise had significantly lower probabilities of buying the same potatoes again as compared to those who purchased the FL657, *ceteris paribus*. On the other hand, repurchasing decisions between consumers using the CS7635-4 and the Superior and those using the FL657 were not statistically different.

As expected, the average composite rating of serving quality in home use had a significant positive effect on their probability of repurchasing. The statistical results also indicated significant consumer loyalty to Idaho russet. Respondents who typically purchased only Idaho russets had a significantly lower probability of repur-

chasing the tested potatoes than those who usually purchased other types of potatoes.

No statistically significant impact of the age of respondents on repurchasing decision was found. However, respondents with household income between $20,000 and $50,000 exhibited a lower probability of repurchasing the tested round white varieties in comparison to those with annual incomes under $20,000.

Summary and Conclusions

This study was designed to test ability of consumers to differentiate visually identical round white potato varieties based on the performance of the potatoes in home use, and to examine how consumer satisfaction, purchasing habits and demographic variables influence the repurchase decision.

The data was obtained from a survey completed by respondents who purchased one of five different round white potato varieties in retail stores located throughout New England. A probit analysis was used to estimate the impacts of factors on the probability of repurchasing the specific test potatoes. The specific factors considered in the model were potato varieties, average serving quality ratings of the varieties in home use, whether they typically purchased Idaho potatoes, the age of the respondents, and annual household income.

From the probit analysis, it is evident that consumers willingness to repurchase the Maine round white potatoes is affected by the variety used and the overall serving quality of the potatoes in home use. Furthermore, whether they typically purchase Idaho potatoes, and income of the respondent significantly influenced the repurchase decision.

The relatively high level of consumer acceptance for FL657 originally found in 1988 continued. The analysis indicated that consumers are more likely to repurchase the FL657 than either the Sunrise or the CS7697-24. No statistically significant difference was evident with respect to the Superior or the CS7635-4. Notably, the probability of repurchase was

Table 3

Maximum Likelihood Estimates for the Probit Analysis

Variable	Parameter Estimate	Standard Error	Change in Probability[a]
CS1	-.2560	.2893	-.022
CS2	-.6517**	.2864	-.105
SUN	-.5569**	.2536	-.075
SUPR	.1100	.3110	.005
SQ	1.6136**	.1994	.090
ID	-.5098**	.2145	-.065
AGE1	-.0742	.2118	-.005
AGE2	-.1930	.2749	-.015
INC1	-.5075*	.2602	-.048
INC2	-.4176	.3151	-.044
Intercept	-2.7439**	.6362	
Pseudo-R^2	0.7351		

* Statistically Significant at 10% level.
** Statistically Significant at 5% level.
[a] Partial effect of independent variable x_k on the probability of repurchasing, $\partial F(Y^*)/\partial x_k = \beta_k * f(Y^*)$. Where $F(Y^*)$ and $f(Y^*)$ are values of cumulative density function and probability density function of standard normal.

strongly influenced by the serving quality of the potatoes, and varieties considered for tablestock marketing should be tested for serving types in home use. It appears that the Maine potato industry would be better served by varietal marketing or by marketing only those varieties with similar and high serving quality.

In addition, Idaho's success in associating russets with "baking" potatoes in the minds of consumers suggests an opportunity for marketing selected round white varieties for use in specific preparations. Market tests can be used to identify which varieties perform best when boiled, mashed, baked or fried. These highly rated varieties can then be differentiated from other potatoes by promoting them for a particular use.

The characteristics and habits of those who solely identified "Idaho Russet" as their usual potato purchase merit particular attention. According to the results of this study, these consumers are significantly less inclined to continue buying any of the tested varieties. However, since they did purchase one of the round white varieties,they comprise a target group for round white marketers. Further research is warranted to understand what motivates these individuals to deviate from their usual buying pattern, what is their general attitude and perception of round whites, relative to Idaho russets, and how they might be encouraged to buy round white potatoes.

Similarly, household income shows a differential effect on the likelihood of repurchasing. Those reporting annual household incomes between $20,000 to $49,999 have a significantly lower probability of repurchasing the tested varieties. Because this income range encompasses a substantial group of consumers, the characteristics of these individuals as potato consumers should be investigated. The eating patterns of this group may differ from others in terms of how often they serve potatoes at home, how they prepare them, and what they use as substitutes for potatoes. Further analysis of these variables may indicate how these consumers can be effectively targeted.

References

Amemiya, Takeshi (1981), "Qualitative Response Models: A Survey," *Journal of Economic Literature*, 19: 1483-1536.

Capps, O., Jr., and J.M. Love (1983), "Determinants of Household Expenditure on Fresh Vegetables," *Southern Journal of Agricultural Economics*, 15:127-32.

Cox, T. L., R. F. Ziemer, and J.-P. Chavas (1984), "Household Demand for Fresh Potatoes: A Disaggregated Cross-Sectional Analysis," *Western Journal of Agricultural Economics*, 9:41-57.

Goodwin, H. L., Jr., S. W. Fuller, O. Capps, Jr., and O. W. Asgill (1988), "Factors Affecting Fresh Potato Price in Selected Terminal Markets," *Western Journal of Agricultural Economics*, 13(2): 233-243.

Kezis, A. S., S. R. Peavey, and D. A. Smith (1988), "Testing for Differences in Consumer Acceptance of Identically Appearing Potato Varieties," *Journal of Food Distribution Research*, September 1988,pp 54-62.

McRae, D. C., J. Fleming, and A. Fisher (9184), "The Development of a Rigid Carton for Retailing Potatoes," *Agr. Engineer*, 39:74-79.

Pindyck, R. S. and D. L. Rubinfeld (1981). *Econometric Models and Economic Forecasts*, New York: McGraw-Hill.

U.S. Department of Agriculture (1986), Economic Research Service. *National Food Review.*

Work, T.M., D.A. Smith, S.R. Peavey, R. True, A.S. Kezis, and A. Bushway (1988), "Investigation of Consumer Attitudes Regarding Marketing of a Potato Product Through Focus Group Interviews,: Abstract of papers given at the 72nd Annual Meeting of the PAA, *American Potato Journal*, 65.