



Current Agriculture, Food & Resource Issues

A Journal of the Canadian Agricultural Economics Society

New Directions in Consumer Behaviour Research

Sean B. Cash

Assistant Professor, Department of Rural Economy, University of Alberta

Ellen W. Goddard

Professor and Chair, Department of Rural Economy, University of Alberta

with

Wiktor L. Adamowicz (University of Alberta), Timothy Beatty (University of British Columbia), J. Stephen Clark (Nova Scotia Agricultural College), John A. L. Cranfield (University of Guelph), Wuyang Hu (University of Nevada, Reno), Bruno Larue (Université Laval), Mel L. Lerohl (University of Alberta), Michele M. Veeman (University of Alberta), and Margaret Zafiriou (Agriculture and Agri-Food Canada)

The Issue

Consumer behaviour remains an evolving and fascinating area of research. In this article we highlight some of the current work by Canadian researchers in the areas of enhancing both the quality and application of consumer analysis. The work described below touches upon areas in which not just economic theory and methods, but also the policy process can be improved. The working papers cited here were all presented as part of the principal paper session, "What's Going on in Consumer Behaviour?" held at the joint meeting of the Canadian Agricultural Economics Society and the Northeastern Agricultural and Resource Economics Association in Halifax, Nova Scotia in June 2004.

Implications and Conclusions

Research in consumer behaviour is a rapidly changing area of study, with great policy relevance. Government attempts to deal with such issues as the social costs of poor nutrition and consumer understanding of new technologies can be enhanced through enriched understanding of what triggers consumer response. Canadian researchers are at



the forefront of developing applied research tools that can help guide better decisions by government and industry.

Background

One of the main tasks faced by applied economists is the analysis of consumer demand for products and services. Despite the bland characterization of this activity by non-economists (and some economists!) as the simple drawing of correspondences between prices and quantity, it is actually an attempt to characterize human behaviour in a wide variety of circumstances. Canadian agricultural and resource economists are not just users of well established methodologies in the areas of consumer behaviour and demand analysis, they are also innovators in these fields. This was particularly apparent at a principal paper session held at the 2004 joint meetings of the Canadian Agricultural Economics Society and the Northeastern Agricultural and Resource Economics Association in Halifax, Nova Scotia. This session, entitled “What’s Going on in Consumer Behaviour?” featured presentations on new ways to model consumer demand, deal with the challenges of household survey data, analyze individual-level data, and apply the lessons of demand analysis to the policy formation process.

Improving the Individual-level Approach

Microeconomics is based on theories about, and observations of, the behaviour of individual agents. Although rigorous conceptual models are well established for the analysis of individual economic behaviour, deviations from the underlying theory are often seen in empirical work. Wuyang Hu of the University of Alberta started off the session by discussing his work with Wiktor Adamowicz and Michele Veeman, which seeks to bridge the some of the gaps between theory and application. Dr. Hu began by providing a contemporary review of the literature on consumer demand analysis. The behaviour of individuals, whether in maximising benefits, minimising costs, making choices under uncertainty, or even in interacting with other consumers, is the cornerstone of consumer demand theory. He then discussed some of the difficulties that are often encountered in applying the underlying theoretically based properties of these models.

The authors proposed to address these difficulties using two sets of established economic theories: the theory of demand for attributes and random utility theory. The former provides the foundation for economic analysis of individuals’ choices when faced with different product attributes. The second theory attaches explicit behavioural interpretations to structural analysis of individual decision-making. When combined, the resulting approach yields a model that has the ability to encompass information from many other disciplines in the search for a better understanding of consumers’ choices. In particular, theories from psychology can be merged smoothly with economic thinking. Dr. Hu and his colleagues have identified a wide range of cognitive or non-economic factors

that can be naturally incorporated into the conceptual framework outlined in their work. These factors may include (but are not limited to) the following:

- Feasible product choice set formation: What products consumers may at least be interested in purchasing, and why certain products may or may not enter this possible choice set.
- Impacts of consumers' taste variability: Individual consumers' tastes for product attributes may vary, which implies that their demand patterns are likely to differ as well.
- Consumers' decision strategies: The processes by which consumers reach their final demand decisions may vary. For example, will consumers consider all relevant product attributes or only a subset of these attributes?
- Intra- or inter-personal interactions among consumers: These types of interactions are expected, but are often ignored by economists in their empirical demand analyses.

In the second section of the paper, the authors continue the conceptual model outlined above and describe a case study involving actual data collected in a survey. There is a renewed interest among econometricians in using Bayesian approaches to solve problems traditionally analysed by maximisation methods. The authors take advantage of the Bayesian approach to address some of the difficulties that are often encountered otherwise. The authors demonstrate that, when combined with the flexibility of their estimation approach, the factors discussed previously can be successfully incorporated into a comprehensive model that in turn improves the understanding of individual consumer behaviour.

Beyond AIDS?

Agricultural economists have spent considerable time and effort modelling demand for food and food products. Much of this analysis has used empirically tractable demand systems, such as the linear expenditure system, the Rotterdam model and the almost ideal demand system (AIDS). However, a quick scan of the demand analysis literature indicates a great deal of inertia with respect to the chosen functional form. As John Cranfield of the University of Guelph noted during his presentation, few of the applied demand studies for food products go beyond the AIDS and/or Rotterdam models. Such inertia is problematic given the limitations of the models used. The AIDS model is a rank two demand system,¹ while the Rotterdam model has constant marginal budget shares.² Such weaknesses limit the application of these models to data sets that show wide variation in expenditure (or income) levels. Moreover, recently developed demand systems offer not only more flexible expenditure responses, but also more flexible price effects.

The objective of Dr. Cranfield's study is to compare and contrast three recently developed models of consumer demand using Canadian food demand data. These models

include the quadratic and modified AIDS model and a rational rank four demand system, all of which are at least rank three demands or fractional demands. Moreover, the generality of these models transcends empirical tractability and hence usefulness, given modern computer technology. The comparative analysis uses nested and non-nested statistical test methods and comparison of Engel and compensated price elasticities.

The rationale underlying the choice of these three specific function forms relates to their Engel and price effects. Banks, Blundell, and Lewbel (1997) generalized the AIDS model by incorporating a term that is quadratic in the logarithm of real expenditure; the resulting model is referred to as the quadratic AIDS (QUAIDS) model. Cooper and McLaren's (1992) modified AIDS model (MAIDS) is a fractional system that satisfies the conditions for effective global regularity. Lewbel's (2003) rational rank four AIDS model (RAIDS) includes a general polynomial of deflated expenditure in the AIDS model. QUAIDS, MAIDS and RAIDS all have higher order rank than the AIDS model. As such, they offer a clear advantage in terms of generalizing existing demand systems, being able to test systems of lower order rank, and estimating Engel curves that inform policy analysis. Moreover, these generalizations come about by including additional price terms in the AIDS model; consequently, all three of the considered models also have more general price responses.

All three models were estimated using aggregate consumer demand data for final goods and services in Canada. Curvature properties were rejected for the QUAIDS model in about half the sample, but were not rejected for the MAIDS and RAIDS models. Engel elasticities for all three models decline over the sample, and follow a similar pattern of adjustment in the latter part of the sample. Further statistical analysis indicates a preference of RAIDS over MAIDS and QUAIDS. As well, the null hypothesis of the AIDS model (which is nested within the RAIDS, MAIDS and QUAIDS models) was strongly rejected. These results suggest that rank two demands (the family of demand systems to which AIDS belongs) are not supported by consumer demand data in Canada, nor are rank three demand models (i.e., QUAIDS).

The direction of future developments will be shaped by theoretical advances related to the mathematical/statistical representation of functional forms. An area rife with potential in this regard is semi- and non-parametric analysis of consumer demand data, and how these models compare to parametric models. One conclusion to draw from Cranfield's work is that economists should move beyond the almost ideal demand system, at least when modeling demand for foods.

Getting Smarter about Zeros and Unit Values

Little space is devoted in most econometric textbooks to errors in variables, even though it is usually accepted that "almost all economic variables are measured with error" (Davidson and MacKinnon, 1993) and that such data problems adversely affect the quality of the statistical inference. In his presentation, Timothy Beatty explained that such

problems are particularly acute when estimating demand systems on household survey data for which prices were not recorded. One problem is that prices are not recorded in many frequently used household surveys, such as Statistics Canada's expenditure surveys (FAMEX, FOODEX) and the U.S. Bureau of Labour Statistics' consumer expenditure surveys. This is not surprising, given the need to aggregate the thousands of specific goods purchased by consumers into a manageable number of categories.

In order to conduct demand analysis with such data, many researchers approximate prices with unit values, defined as the ratio of expenditure to quantity in a given expenditure category. A problem arises when there are many varieties of the same good, in that differences in unit values across households may reflect differences in composition rather than differences in prices. For example, the unit values for veal meat can differ by as much as \$20/kg from one household to another. Clearly, poor price arbitrage is not the main factor behind such a differential. Instead, it illustrates the problem that unit values are endogenous components that are treated, more often than not, as exogenous. Although it may be expedient to assume that unit values are a good proxy for prices, this can lead to biases in estimated price elasticities.

A related issue that frequently arises with household survey data involves the reporting of zeros in survey responses. Because the period over which households are surveyed is usually short, each household exhibits purchases for only a subset of the goods included in the survey. Researchers do not know whether the zeros are due to high prices, a general aversion to the good (e.g., cigarettes for non-smokers), or recent purchases before the survey period. Since only positive purchases are usually entered in the data files, researchers must first generate the implicit zeros and then develop useful proxies for the unit values.

One common approach to dealing with this problem is to aggregate the zeros away by defining broad categories of goods such as food, clothing, and housing. Although this can be justified on theoretical grounds and also simplifies other aspects of analysis, it is an unsatisfactory solution for the economist who is interested in looking at the demand for more narrowly defined groups of goods, such as a specific type of food. Another set of approaches involves the estimation of Tobit models or "double hurdle" approaches. An example of the latter is the two-step estimator developed by Shonkwiler and Yen (1999). Other methods include Kuhn-Tucker and information-theoretic approaches.

Various techniques have also been developed to address the unit value problem. One relies on the assumption that households with similar socio-demographic characteristics purchase, on average, the same varieties and therefore face the same prices. The desired price instrument can be constructed from the estimated coefficients of regressions. Unfortunately, economic theory is not particularly insightful in helping researchers to identify the "right" socio-demographic variables. As a result, the price regressions provide weak instruments. Another approach is to assume that households living in a particular area face the same prices, and that differences in unit values between these households

result strictly from quality/bundle composition effects. Prices are allowed to vary only from one area to another and over time. The difficulty with this approach has to do with the construction of clusters, as information about the exact location of households is often deliberately vague in reported data due to confidentiality concerns.

Dr. Beatty and his collaborator, Bruno Larue of Université Laval, have combined the Shonkwiler and Yen approach to dealing with the zeros with a three-stage estimation of an AIDS model with endogenized unit values that exploits the geographic cluster approach described above. This approach builds on the work of Deaton (1988, 1990) and Crawford, Laisney, and Preston (2003). Beatty and Larue's innovation is not just to combine these two approaches to dealing with the vagaries of survey data, but also to link data from a household survey (in their empirical exercise, from the 1996 Family Food Expenditure Survey) with a separate survey of food prices. The out-of-sample price information allows them to directly estimate price index parameters. They find that the additional information that this provides yields a considerable increase in the precision of demand estimates.

Food Policy and Consumer Health Behaviour

Concerns around the social costs associated with poor, inadequate diets and unhealthy food choices have received much attention in both the popular and academic literature recently. In response, governments are starting to direct their attention toward reviewing existing policy and developing new policy that relates to the interplay between public health and the food economy. Public policy in this area relates to such goals such as risk management, reducing health care costs, increasing quality of life, reducing productivity impacts of illness, and providing clear indicators of food quality, healthiness, and safety. Ellen Goddard concluded the session by discussing some of the work she has been pursuing on these issues with her colleagues Sean Cash and Mel Lerohl at the University of Alberta. She argued that in order to be effective, new policies must take consumer behaviour into account.

Dr. Goddard began by reviewing some of the known links between food and health, as well as some of the recommendations coming from international bodies such as the World Health Organization and the United Nations Food and Agriculture Organization. These suggestions include limiting energy intake from fat; increasing consumption of fruits, vegetables, legumes, and whole grains; limiting the intake of free sugars; and engaging in adequate levels of physical activity (World Health Organization, 2004). Many of these policy goals involve attempts to influence the individual food choices of consumers. This can only be achieved by explicitly taking consumer behaviour into account. As Philipson et al. (2004) note, "Individuals make [food] choices in the context of limited time and income available in the presence of competing goods and activities with the objective of attaining multiple outcomes or goals, only one of which is health. The discipline of economics studies people's choices under precisely these

circumstances.” Despite this, little work has been done to connect the findings of medical and nutritional researchers to the insights provided by economic analysis. Much of this has been due to economists being slow to step up to the plate. For example, the authors could find no peer-reviewed research on the economics of obesity in Canada.

In order to make progress toward societal health goals, economists should model consumer behaviour in the context of policy instruments such as agricultural input subsidies, price supports, nutritional and health hazard labelling, social marketing, advertising restrictions, “fat taxes,” and consumer subsidies. The role of information in changing consumer behaviour is an important element of many of these instruments, and appropriate methods for incorporating information into demand models are still in their infancy. The resulting gaps in the literature are in areas that are sorely needed for policy formulation. For example, although there is a fair amount of evidence on the impact of both generic and brand advertising on the sales of individual foods, little is known about the effects of advertising on food substitutions, overall nutrient intake, or the confounding effects of restaurant advertising. Other policy areas that have not been adequately addressed are the effects of fat taxes on health, the impacts of restricting product availability in schools, and the long-run effects of changes in nutritional labelling in Canada.

Dr. Goddard and her colleagues argue that Canada, as a small yet wealthy country with a well-defined regulatory system, is well positioned to assume the role of an exporter of both healthy foods and healthy food policies. At the same time, the failure to incorporate consumer response into the policy-making process has led to suboptimal, and even perverse, outcomes in the past. In order to achieve better results today, government agencies must heed the lessons of economics, and economists must step up to the challenges of providing better analyses of consumer behaviour.

Discussion

Margaret Zafiriou of Agriculture and Agri-Food Canada (AAFC) and Stephen Clark of Nova Scotia Agricultural College provided comments on the session papers, as did members of the audience. Ms. Zafiriou noted that consumer demand seemed to disappear from the screen of government researchers for quite a while, as policy makers were particularly concerned about designing new safety net programs in the wake of the CUSTA and the NAFTA and agricultural policy and trade reform. Only recently, during the development of the new Agricultural Policy Framework (APF), which became the policy framework for the federal department of agriculture and provincial counterparts, did we begin to hear once again about the changing consumer and his or her impact on the agriculture and agri-food sector. The APF identified several policy priority areas, among which were food safety and quality, environmental sustainability, business risk management, innovation, trade and renewal. It became clear that consumers were behind

many of the initiatives in the food safety and quality area, driving the need for assurance systems and regulations.

Suddenly, government is again interested in how consumers are changing and how this changing behaviour is affecting agriculture and the food industry. This interest includes questions related to how industry is restructuring in response to the greater need for traceability and questions related to private versus public standards. It also includes questions around the role of government in ensuring that markets are responding properly to the emerging trends that are shaping developments in the demand for food and food quality attributes.

We are hopeful that, based on the four papers discussed in this session, the research community will make progress and provide leadership and guidance for future work that needs to be done. Without a better understanding of consumer behaviour, we will not be able to characterize changing consumers and their demand for food and food quality attributes, and the role government and industry must play in responding to these changing consumers. Decision makers will look to the academic community to continue to move the research agenda forward in the area of consumer demand for food, so that better policy decisions can be made in the future.

Working Papers Cited

The working papers presented at the principal paper session, “What’s Going on in Consumer Behaviour?” held at the joint meeting of the Canadian Agricultural Economics Society and the Northeastern Agricultural and Resource Economics Association in Halifax, Nova Scotia in June, 2004, are listed below. Please contact the authors for additional information. The authors also gratefully acknowledge the contribution of the session discussants, Stephen Clark of Nova Scotia Agricultural College and Margaret Zafiriou of Agriculture and Agri-Food Canada.

Beatty, Timothy, and Bruno Larue. The problems with the prices and zeros in demand analysis conducted on household survey data.

Cranfield, John A. L. Beyond the almost ideal demand system?

Goddard, Ellen W., Sean B. Cash, and Mel L. Lerohl. Integrating food policy and consumer health behaviour.

Hu, Wuyang, Wiktor L. Adamowicz, and Michele M. Veeman. Individual-level approaches to demand analysis: Innovations and challenges.

References

Banks, J., R. Blundell, and A. Lewbel. 1997. Quadratic Engel curves and consumer demand. *Review of Economics and Statistics* 79: 527-539.

- Crawford, I., F. Laisney, and I. Preston. 2003. Estimation of household demand systems with theoretically compatible Engel curves and unit value specification. *Journal of Econometrics* 114: 221-241.
- Cooper, R. J., and K. R. McLaren. 1992. An empirically oriented demand system with improved regularity properties. *Canadian Journal of Economics* 25: 652-667.
- Davidson, R., and J. G. MacKinnon. 1993. *Estimation and Inference in Econometrics*, p. 210. New York: Oxford University Press.
- Deaton, A. 1988. Quality, quantity, and spatial variation of price. *American Economic Review* 78: 418-430.
- Deaton, A. 1990. Price elasticities from survey data: Extensions and Indonesian results. *Journal of Econometrics* 44: 281-309.
- Deaton, A., and J. Muellbauer. 1980. An almost ideal demand system. *American Economic Review* 70: 312-326.
- Gorman, W. 1980. Some Engel curves. In *Essays in the Theory and Measurement of Consumer Behaviour*, ed. A. Deaton, pp. 7-30. New York: Cambridge University Press.
- Lewbel, A. 1991. The rank of demand systems: Theory and nonparametric estimation. *Econometrica* 59: 711-730.
- Lewbel, A. 2003. A rational rank four demand system. *Journal of Applied Econometrics* 18: 127-135.
- Philipson, T., C. Dai, L. Helmchen, and J. Variyam. 2004. The economics of obesity. Report on the workshop held at USDA's Economic Research Service, USDA, Washington, D.C.
- Pollak R., and T. Wales. 1992. *Demand System Specification and Estimation*. New York: Oxford University Press.
- Shonkwiler, J. S., and S. T. Yen. 1999. Two-step estimator of a censored system of equations. *American Journal of Agricultural Economics* 81: 972-982.
- World Health Organization. 2004. *Draft Global Strategy on Diet, Physical Activity, and Health*. Geneva, Switzerland.

Endnotes

¹ For all demand systems that are linear in functions of income, demand system rank is the maximum rank of a matrix of coefficients associated with functions of income (or expenditure). More precisely, demand system rank is the "...maximum function space spanned by the Engel curves of the demand system," (Lewbel, 1991, p. 711). Gorman proved the rank of such a demand system is at most three; thus, such demand systems are referred to as "full rank demand systems." The concept of rank is useful in developing a taxonomy of demand systems according to Engel curve shape. Rank one demands, the most restrictive demand systems, are independent of income; rank two demand systems are less restrictive, allowing for linear Engel curves not necessarily through the origin;

while rank three (i.e., full rank) demand systems are least restrictive, allowing for non-linear Engel responses.

² A marginal budget share is “the fraction of an additional dollar of expenditure spent on each good” (Pollak and Wales, 1992, p.5).