

THE QUALITY CONUNDRUM: MANAGING OUR WAY OUT OF CRISIS

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ABSTRACT

Faced with a growing crisis as consumers turned to foreign-made automobiles, appliances and other consumer goods, many American manufacturers have launched major quality improvement programs. This new emphasis on product quality is very good news for consumers. But it is only half the story. The real revolution that is occurring is the change in attitude and management style in those companies that have taken the process of quality improvement and self-examination several steps further. Here an entirely new definition of quality is emerging.

"Quality" in this context does not mean expensive or high class. Here quality means "meeting the customer's requirements -- on time -- 100% of the time." What businesses are finding is that the traditional quality control approach is very costly, and that preventing errors is both more efficient and less expensive than detecting and correcting mistakes.

This concept of error prevention is a new business strategy. But there is an important human element: the key to error-free work is communication, involvement, pride and respect. Under the banner of "do it right the first time", there is a new commitment to quality and excellence in both product and individual performance, from boardroom to shop floor.

The concepts are simple. But they are profound in their impact and may, over time, change the face of American business.

THE QUALITY REVOLUTION

There is a quiet revolution taking place in American business. It is the quality revolution. It started slowly, and not too long ago, but it promises to sweep through more and more companies, and with great impact. Why is this of any interest to consumer leaders? Because, as one IBM spokesman put it, "Certainly business benefits, but the real winner is the customer." Beyond that, a serious commitment to quality is a major factor in rebuilding our economic strength and a key to our ability to compete in tomorrow's international marketplace.

What makes this movement different from other recent business theories or strategies is the expanded new definition of quality. Following this definition to its logical end gives the quality movement social and economic implications as sweeping as the civil rights and women's rights movements.

Quality is, first, a standard of work that applies throughout an organization. Quality here means "doing things right the first time," "zero defects," and "error-free work." It is an attitude and a personal commitment to excellence. It is pride in doing a job well and not settling for second best. It is providing the customer what he or she requires, be it a product or a service or the answer to a question on which the customer can rely with confidence.

Quality here also expands the notion of "customer" to include not just retail purchasers or end-users, but those who are "customers" for our daily work -- co-workers, bosses, subordinates and peers. In this context, quality performance becomes knowing who the customer is for each project or task, understanding what the requirements are, and meeting those requirements -- on time -- every time.

The traditional notion of quality for most of us is related to some standard of "goodness" or social status, and for products this usually means expensive. In this sense cashmere is quality material, polyester is not. A Mercedes-Benz or a Lincoln Continental may be viewed as a quality car while a Ford sedan with black-walled tires and no chrome is not. In the new context of quality, this common definition, Webster's notwithstanding, not only is irrelevant, it often confuses the issue.

There is another semantic hurdle to overcome when discussing quality in the business community. For manufacturing companies in particular, the word quality immediately triggers the concept of product quality. Attention automatically goes to the complex systems by which quality standards, quality control procedures, and ship/no ship decisions are established and implemented. Here again the old definitions get in the way. Just as some moral notion of "goodness" is not appropriate, product quality by itself is too narrow and too limiting a definition. While this new quality concept certainly embraces products, it is bigger than that. I will come back to the definition later, because it is key, but for now let me say once more that the new quality programs are based on both a philosophical concept and a behavioral commitment. What is changing are basic values.

THE ORIGINS OF THE NEW QUALITY MOVEMENT

Where did all this come from? What is motivating it? And perhaps more importantly, is it for real, or is it merely a management fad or a cosmetic device for advertising purposes? Ask most workers in the private sector about the buzz words of the last decade or two and they can rattle off a litany of PPBA, MBO, ZBB and productivity theories, most

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of which were superseded by the ideas of the next wave from the business schools.

The quality movement is different, I think, because it had its origins in what was becoming a deepening crisis. The best-seller list has reflected widespread public preoccupation with economic theory, international business competition, management techniques, the politics of industrial planning: Theory Z, The One Minute Manager, The Zero Sum Society, The New American Frontier, The Art of Japanese Management, and still at the top of the list, In Search of Excellence.

We are engaged in a serious and perhaps critical process of self-examination because we are hurting. Having dominated the world economy for almost three decades after World War II, we found ourselves in trouble in the 1970's. The richest nation in the world, the best-educated population, the most skilled workforce -- and we were losing the competitive edge in the marketplace, both international and domestic.

At the risk of oversimplifying an admittedly complex set of factors and events, we can identify a theme that, for consumers at least, was central and recurring: the quality of many American-made goods was perceived to be declining vis a vis those of our major competitors. The supreme irony, of course, is that preeminent among the new entrants to world competition was Japan -- whose consumer goods for years had been equated with flimsy, low quality, disposable "shlock." All of a sudden, it was not paper lanterns and toy flashlights anymore, it was cars, trucks, stereos, televisions, household appliances and consumer electronics.

Common wisdom had it that American consumers were finding many imported products to be superior to those made in the U.S.A. Better quality, better value for the price, a better buy -- but better. Survey after survey detailed the consumer conclusion that the quality of U.S. products had declined, in absolute as well as relative terms. The majority opinion was that we had slipped, and slipped badly. Not so, said some -- among them many corporate executives.

Writing in the Harvard Business Review in the Fall of 1982, Harvard Professor Earl Sasser and management consultant Frank Leonard agreed with this minority view. They argued that the quality of American goods and services had never been higher. The problem, they said, was not inferior U.S. products but Japanese and German attention to producing superior products of their own.

It does not matter who was right on that score. The fact was that consumers in droves were bypassing U.S. products for imports in many highly visible and economically important areas. Automobiles were the prime example. By 1980, the Japanese had captured 22% of the U.S. car market. Or take television sets. In 1968, eleven percent

of the color TV sets sold here were from Japan; eight years later, Japanese sets represented 35% of the U.S. color TV market. We make virtually no black and white television sets any longer; nor are there any 35mm cameras made in the United States today. Consider the \$1.3 billion consumer dinnerware market. Here imports accounted for 43% of sales in 1976. Last year this rose to 65%.

The ultimate impact was to threaten American jobs, communities and entire industries. For a time it seemed that we looked for scapegoats more diligently than we sought solutions. I recall an in-depth survey published by the Boston Globe in January of 1981 which probed the issue of declining quality and the perceived causes across New England, an area very hard hit by foreign competition. The results were interesting. Consumers accepted some responsibility (i.e., for accepting poor quality), but they also blamed quality problems on the poor attitude of workers. Workers blamed management. Management blamed government. The recriminations became very shrill, and much anger and frustration ultimately focused on government regulation as a major perpetrator and continuing source of our economic ills. This did not get us very far.

The internal problem was, and still is, much more pervasive and much more deeply rooted. Few would argue that as a nation accustomed to success and a standard of living that continued to rise for most of us, we had become fat and complacent. To the degree that we are all consumers, and we are all workers, each of us probably bears some responsibility. The problem was no one knew what to do.

But the crisis of the 70's and early 80's eventually delivered such a shock to the system that a response was essential. For business, the first imperative was simple: do something to improve product quality and regain competitive vitality or risk further market loss, declining profits, plant closings and job terminations. Major quality improvement programs were initiated by the auto companies, and other manufacturers began to examine all aspects of their production process. They began to tighten standards and to beef up the quality control inspection system. Improvements in product and customer service were added -- repairs, parts, warranties, product information, consumer complaint handling, 800 lines; trying to change consumer perceptions and purchase decisions became urgent. General Electric, for example, invested several million dollars in a comprehensive study in 1980-81. On the basis of the findings, G.E. launched an unprecedented consumer service system the following year, offering everything from a library of specially prepared do-it-yourself manuals to a toll-free 24-hour, 7 day a week consumer information hotline manned by product experts.

What the industry leaders found, however, was that a real solution required more. It is not enough to find and fix mistakes after the fact. Not only is there a great deal of waste and expense in this, but this approach does not

always enhance one's reputation in the marketplace. Managers of the ultimate find-and-fix program, product recall, know this lesson well. The better strategy is to prevent problems, mistakes, errors before they happen. To be able to do so is not easy. First you have to find them, and, unfortunately, the place where mistakes surface is often far downstream or (to stretch this analogy a little more) far across the river from where they originated. It can be a Herculean task to understand the complex flow of any modern business well enough to identify problem areas early. It requires the help and support of everyone in the organization. It is this conclusion, and this commitment to building such support, that is revolutionizing business thinking today.

FROM PRODUCT QUALITY TO ORGANIZATIONAL QUALITY

The search for understanding led first to a study of the most highly successful Japanese companies, and then to those who taught the Japanese. Herein another irony: today's quality gurus are Americans who were ignored by their compatriots in the U.S. post-war industrial boom. Chief among them are Joseph M. Juran, W. Edwards Deming, Armand V. Feigenbaum. They, along with others such as Philip M. Crosby, currently command huge audiences and large fees for their writings, speeches and classroom seminars. The thesis is always the same: Quality is a winning business strategy. Crosby, former quality control director for ITT, runs a Quality College in Winter Park, Florida, that packages concepts and action steps for over 500 business managers a month. Industry Week magazine recently estimated that the demand for quality consultants across the board has increased 100 fold since the mid-1970's.

What are these experts saying and teaching?

For the companies that have embarked on a total quality effort, there are two key themes:

The first is basic behavioral psychology: most people want to do a good job. The second is simple economics: it costs less, not more, to do things right the first time.

Let's take these in reverse order. To explain the economic point, the quality experts introduced a new concept; the cost of quality. Crosby and others break the cost of quality into two basic categories. The first is the cost of making errors, which includes such things as rejects and scrap, unused inventories, the cost of product redesign or recall, retyping a memo, high employee turnover. The second category is the cost associated with preventing and detecting errors in the normal system. This includes the money spent for worker training, preventive maintenance, product inspection, copy proof-reading, financial auditing, etc.

If these costs associated with quality assurance and quality failures are fully analyzed and added up, say the experts, most companies will

find that the total is somewhere between 10% and 30% of gross sales. For a company like IBM, with sales of over \$34 billion, the cost of quality is \$3 billion to \$11 billion a year. If there is an opportunity to reduce this cost by even 5% or 10%, can you wonder that IBM was among the first major organizations to launch a full quality improvement effort some six years ago? The stakes are not always so high, but the bottom line impact can be very impressive. Take the example of another electronics company that invested \$250,000 in new instruments and process refinements and cut waste on one production line by \$2 million in one year. To achieve the same results from revenues, the company would have had to double sales. The news magazines and business journals today are full of stories about specific savings directly attributable to efforts to improve the quality of products, manufacturing processes and individual worker performance.

It is obvious that, first and foremost, financial considerations motivated those business leaders and managers who were and are listening to the quality experts. The potential bottom line rewards also make it easier to swallow the uncomfortable message uniformly preached by Juran and Deming and Crosby: quality is a management problem, not a worker problem. They say that the biggest and most costly mistakes occur high up in an organization, not on the factory floor. The crusty Juran has gone so far as to say that quality has been of no concern to managers ("no manager ever lost a job because he didn't act on quality"). It is this attitude that has "robbed the hourly worker of his right to be proud of his work."

This is the human theme of the new quality movement: most employees want to do a good job, and they respond to the standards set for them. The quality successes of Japanese manufacturers may have little to do with cultural distinctions, specific organizational structure, labor/management relations, or even government support programs. The difference is that the zero defect philosophy has been stressed. The Japanese worker knows what is expected of him, and he is rewarded and recognized when he performs well. In the most successful Japanese companies, quality is everyone's job. In our system, we have not only expected and accepted mistakes, we have formalized a system which describes how many errors are O.K. (AQL), and then we have made a few quality control personnel responsible for enforcing the standard on the production line. This creates two problems. First, it institutionalizes conflicting objectives those of quality control workers vs. those of people in sales, marketing, manufacturing and shipping. Second, it ignores quality as a factor in other functions of the organization.

Drawing on the experience of the Japanese, Americans have begun to identify those components which are essential to a total quality effort. These elements, regardless of business, product or service, are generally the same:

- 1) A major, long-term commitment by top manage-

ment to quality performance and quality products throughout the organization. This is essential to the credibility of the effort.

- 2) Open lines of communication, up, down and across the organization, and an emphasis on clarity and accuracy of communication. This is critical to employee understanding of the organization's objectives, the individual job, and the requirements of each specific function, project or task.
- 3) Worker involvement and participation in problem identification and problem solving, because the person closest to the work is the one who understands it best. This often draws upon a cross-functional, multi-disciplinary team or task force approach.
- 4) Ongoing education and training, to be sure that employees at all levels have the tools and skills necessary to do their jobs.
- 5) A system of recognition and reward that clearly places high value on individual and group commitment to quality performance.

Virtually every company that has undertaken a commitment to a full quality program recognizes that it is a long-term, never-ending process. And while the initial investment in time, energy and money may be considerable, there are also very early returns, both financial and psychological. My experience at Corning, a company now dedicated to Total Quality, is that momentum begins to build as the concept is understood and there is a cascade effect through the workforce. This eventually extends as well to vendors, suppliers and customers. Over time, new language takes hold, values begin to change, every day attitudes and job performance reflect a commitment to quality...the new definition as "knowing what needs to be done, having the tools to do it right, and then doing it right -- the first time." Simple concepts that are an amalgam of good management principles and common sense, but profound in their effect and their implications for the future.

I can perhaps sum up best by stealing the words of James Kuhn, Professor of Business at Columbia, as he concluded a Productivity Forum symposium last fall. After expressing initial skepticism about the idea of increased productivity through quality of life efforts, Professor Kuhn said:

"I now believe that something more is involved than a temporary rescue effort, with a probable return to business as usual... (the quality companies) are involved in what in the future will be seen to have been as historic a change in business as those of Carnegie before the turn of the century, and Ford after... earlier changes and transformations professionalized and rationalized American business -- encouraged and permitted large-scale organizations, with their attendant engineering efficiencies... they were mechanistic in describing connections among people; and they valued only the objective... mathematical dimensions of work, consumption and life.

(What we are witnessing) are experiments in which managers, employees, and union leaders are looking for new definitions of relationships... I believe that the definitions are more radical and basic than the participants may realize... They recommend to themselves and us wider values and deeper bases of meaning than most business has used for a century. It is not only a pursuit of quality -- or excellence -- but a rejection of the objective, mechanistic, elitist, narrow notions of profitability, efficiency and productivity, to consider and incorporate the broader talents and capabilities of all of us involved....

The new quality program builds upon traditional American values -- democracy, participation, individuality within community -- all that have historically given Americans a sense of being a part of the "City on the Hill" -- a chosen people. This has given me more hope about business imagination and innovation than I have had in years. Its success is not guaranteed -- failure is both possible and probable -- but it is exciting for the opportunities and future it opens up."

I agree with Professor Kuhn. What is happening is very exciting. A commitment to quality is good for the consumer, good for business, good for employees and good for the economy. It will not solve all the problems we have with competitors abroad, but it can do something else: return to us pride, confidence and respect as individuals joined in a common effort, and standard bearers committed to excellence.

Thank you.

NORMATIVE HOUSEHOLD EXPENDITURES--
OF WHAT USE FOR FAMILY BUDGETING?

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ABSTRACT

Family resource management specialists often respond to requests for budgeting assistance by providing average percentages of spending by budget category for some sample of households. These averages are not sufficiently reliable to provide reasoned budgeting guidance for families. There is a knowledge base in family economics that should be used to provide direction for families in budgeting income.

When estimating expenditures in the process of budgeting family income, it is understandable that families seek the answer to two questions: "What should I be spending for ...clothing... recreation...?" and "What do other people like us spend for ...food...housing...furniture?" Such requests give rise to more questions than answers for the family resource management specialist attempting to be of help to families in their budget plans. Do we presume to tell people what they "should" spend? Do we have reliable data on household spending? Could we, perhaps, help our clients clarify their budgeting problems and frame questions that we can answer and that will provide a more constructive direction for budgeting household income?

EXPERT STANDARDS FOR BUDGETING ASSISTANCE

Only in the area of food consumed at home have we presumed to suggest what should be spent by a household of given size and composition in order to provide a nutritionally adequate diet. [6] Beyond that, there are no validated expert judgments for consumption to meet minimum standards. In our society, consumption standards are socially derived rather than based on biological needs; therefore, it is understandable that attention turns to normative, or "typical," spending patterns as guides for budgeting.

Even the Bureau of Labor Statistics Budget Standards that have been so widely used were derived, in part, from actual spending patterns to reflect socially accepted living standards. These budget standards have been abandoned by the Bureau. The "typical" wage-earner family with two children and homemaker wife which is the reference point for the family standard is no longer representative of the pluralistic society of today. It is not feasible to develop and maintain budget standards for a diversity of family types. For family budgeting purposes, the loss of these standards will make little difference. The statement issued with each release of the budgets has always stated, "The budgets were not intended to represent a minimum level of adequate

income or a subsistence level of living, nor do they indicate how families do or should spend their money." [4, p. 46]

NORMATIVE EXPENDITURE PATTERNS

If we cannot provide answers to the question "What should we spend for ...," can we perhaps answer the question "How do other families like us spend money?" The answer would not demand the careful judgments required in forming expert standards, but it demands a very ambitious data collection effort.

Gathering reliable data on family expenditures is one of the most difficult survey research challenges. The respondent's memory of purchases is unreliable, even for a daily diary method. There are privacy matters related to many spending categories (alcohol, gambling, prostitution), and even if these particular categories are not of interest, understatement of spending in these areas affects the percentages spent for other categories. Finally, the realities of funding constraints make it impossible to represent a diversity of household types with acceptable reliability.

The national surveys of consumer expenditures published by the Bureau of Labor Statistics are a tempting source of data for those interested in typical expenditure patterns. Although national in scope and now providing a longitudinal data base of expenditures, these surveys suffer from all the limitations put forth above. In addition, the surveys are limited to urban households only and the methodology is appropriate to the intended purpose of the surveys; that is, to provide a means for updating the market basket of the Consumer Price Index.

If the surveys were intended for the purpose of providing normative expenditure patterns for various types of households, a different survey methodology would be used. For example, the only independent variables available are those demographic characteristics of interest to the B.L.S. for purposes of weighting the sample to represent the national population. Factors significant in predicting household spending--health status, responsibility for family members not living at home, commuting to work, et cetera--are not available. There is no attempt to get a quota of diverse family types such as would be desirable for guiding family budgeting. Categories of infrequently purchased items (appliances, furniture, automobiles) have many zero values reported for the three-month survey period. [5] Finally, the categorization used by the B.L.S. is not the most suitable for family

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budgeting. Recreational vehicles are included in recreation although most families would not consider such a big-ticket purchase part of their recreational spending. Payments on the mortgage principal are not included in shelter expenses although most families would do so. Finally, childcare services are not visible in the published categories although this is a major item for many families.

The most serious limitation of the Consumer Expenditure Survey data is that the number of cases is too small to derive reliable estimates of spending for any particular type family. This limitation will be even more significant with the continuing survey data which is now being published because the sample size is about half that of the 1972-73 survey. [3, p. 1] For example, the number of low-income (below \$5000) respondent households with a middle-age head (age 45-54) in the 1980-81 diary data is 119. [3, p. 64] This sample of 119 represents a wide diversity of household types-- male and female head, various race and ethnic origins, all metropolitan areas in all regions of the country, all size households, and both homeowners and renters, as well as various personal and social characteristics such as occupation, health status, et cetera. It is not possible to obtain reliable estimates of spending from such a small number of cases representing such diversity in household characteristics.

It is sometimes suggested that if one were to specify a particular type of household, reliable estimates of spending could be obtained since the cases included in the average would be homogeneous. However, the number of cases in the 1972-73 Consumer Expenditure Survey data falls precipitously as household characteristics are specified more completely. Hanna reported 61 cases in the 1973 data that met the criteria of 4-person husband-wife family with income from 12 to 15 thousand dollars in a metropolitan area with head over 34 and not retired. This is not an uncommon type of family and yet it is noted, "We have not yet controlled for education or occupation of the head, ages of children, or other household members, or other factors that likely influence spending." [5]

Further analysis of the 1973 expenditure data compiled by Hanna revealed that relative variation increased as household characteristics were specified more completely. [6] Only for one spending category, utilities, and one household characteristic, homeowner-renter status, was there a reduction in relative variation when the additional characteristic was specified. Variability among households with the same characteristics was as great or greater than variability between types of households. Specifying additional characteristics has only a small effect on the mean, but tends to reduce the reliability of the estimate. [6]

Family resource management specialists attempting to help families budget should look critically at averages from expenditure survey data. Are

these averages reliable enough to have meaning for family budgeting? Why do we not report measures of variability as well as means? Isn't there a great deal of room for variation in spending and still be "normal"? Are we conveying this to our clients? Have we read the documentation that accompanies the published survey data?

The expenditure data should be interpreted with care. The expenditures are averages for all consumer units with the specified characteristics regardless of whether or not a particular unit incurred an expense for that specific product or service during the recordkeeping period. An individual consumer unit may spend more or less than the average depending on its particular characteristics. For example, the average weekly expenditures on food at home for all consumer units was about \$34 while four-person consumer units reported spending an average of \$49 per week on this category. Other factors also influence expenditures. Furthermore, even within groups, the distribution of expenditures varies substantially. These points should be considered when relating reported averages to individual circumstances. [1, p. 3]

The B.L.S. consumer expenditure surveys are not the only source of data on household spending. However, other sources are likely to be even more limited in the diversity of household types and place of residence which can be reliably represented by average spending figures. Furthermore, unlike the B.L.S., localized spending studies often rely merely on volunteer respondents rather than implementing scientific sampling procedures, compromising further the usefulness of the spending estimates.

ALTERNATIVES FOR FAMILY BUDGET ASSISTANCE

Do we want to guide family spending by producing estimates of "average" household spending? Are we comfortable suggesting that our clients spend money according to typical patterns? Do our values as family resource management specialists endorse the spending for alcohol, tobacco, insurance and other categories as it appears in these estimates? It is interesting to note that in other areas of family functioning (nutrition, exercise, parenting, home energy use), experts do not point to typical behavior as the standard. Indeed, psychologists frequently emphasize a wide range of "normalcy" for clients concerned about their individual behavior. We need to recognize the uniqueness of each of our clients, and should also recognize that each of the respondents in expenditure surveys has unique characteristics, making their particular spending patterns no more "right" than those of the families requesting our assistance.

One might conclude that attention to normative expenditure patterns as guides to family budget-

ing increased as a result of computer programs that could produce lists of average spending for a set of household characteristics as input. Can we find better ways to apply contemporary technology in helping families plan spending? What is the question we can answer for clients requesting help in planning spending?

The framework of expert systems provides the answer. [8] This aspect of artificial intelligence allows us to capture in computer programs the actual data base and decision rules that we as experts would use in helping families estimate spending. For example, we have sound information on what it costs to own and operate a vehicle of specified type. Isn't this more useful for a family that owns, or is considering purchasing, a given automobile than an average percent spent on transportation by some sample of households? We know how to help a family calculate its need for various kinds of insurance and could develop localized data for estimating premiums for certain coverages. Computer technology can, of course, be of tremendous help in delivering this service. But the computer should be used to do only what we as experts would feel accountable in doing with paper and pencil.

It is unfortunate if we allow the pressure to demonstrate virtuosity with computer hardware in public exhibits compromise the expertise that we possess. Many of you have seen the stores in shopping centers where your photograph is printed on computer paper. The results hardly do justice to portrait photography, and surely interest in such gimmicks will be short-lived. Let us take care that our displays of computer use do justice to our understanding of household economics, as well as computer know-how.

There is also the possibility of presenting case studies of family spending to satisfy the curiosity of those who want to know "How do other people spend their money?" Remember the series in popular magazines such as "How America Spends Its Money?" The data that we have on household spending could more reasonably be presented as case studies, embellished with hypothetical names to appeal to clients. The reliability of the averages hardly justifies doing more than presenting the estimates as case studies.

And, of course, we need to do more "goal-oriented" planning with our clients. For example, if they ask "How much should we spend on utilities?", the answer should not be an average of some sample of respondents. The real answer is "as little as possible and still meet family's standards of comfort and health." Expert advice would call attention to thermostat settings, insulation, and conservation practices.

We should turn our client families in the direction of more inner-directed goal setting. David Riesman in The Lonely Crowd [7] compared the locus of control of persons who rely on a gyroscope to give them inner direction in their lives and those who rely on a radar to guide themselves by

sensing the direction in the world around them. We would better serve the families depending on us by helping them construct "gyroscopes" for financial management, rather than merely reflecting a behavior pattern we sanction with the word "average." It is not only the answers we provide, but the questions we are willing to answer, that give direction to the families we serve. And it is up to us to help frame those questions.

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COMPUTER ASSISTED FINANCIAL DECISIONS

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ABSTRACT

Rapidly changing technology is transforming the way Extension Agents work with clientele. This article describes the way the Pennsylvania Cooperative Extension Service is using computer technology to assist clientele with financial decisions. The process of finding, adapting, and developing computer programs is explored.

INTRODUCTION

The world is experiencing dramatic changes that will continue throughout the 80's and 90's. By 1988, there will be notebook size personal computers available that may rival the pocket calculator as the tool no adult would be caught without. As technology continues to invade every aspect of our lives, there are bound to be changes in both formal and non-formal educational systems. Changes are already taking place within the Cooperative Extension Service. The beneficiaries of technology will be both clientel and Extension Agents. Technology is very important in pushing Extension towards change. Traditionally, Extension has been reactive to change rather than proactive. In Pennsylvania, our administrators and the Pennsylvania Council of Cooperative Extension Associations, our lay leader support group, have been very proactive on the emerging technologies and in my estimation, should be congratulated. The fast pace of technology has kept administrators, specialists, and agents on their toes. The Pennsylvania Legislature is being asked for a one time \$2 million dollar appropriation to provide personal computers for each county, state specialists and administration. The bill also includes funds for a computer communications network to link all offices and for the purchase and development of software programs. It is possible, depending upon the price of computers at the time of purchase, that each agent and state specialist may have their own computer. Currently, thirty-four of our sixty-seven counties have an Apple II+ or IIfx computer.²

The key to future success for using computers in Extension programming is having staff trained to use the technology, and being able to provide reliable, up-to-date, unbiased information to

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clientel. Extension clientel are becoming more sophisticated money managers, asking for increasingly more and more information. Computers are making it easier to present family economics programs; programs showing how changes in patterns of spending and saving can affect the family. Each time we take computers out for an exhibit, crowds gather with clientele asking as many questions about the technology as they do about the educational program we are presenting.

Whatever the long term future holds, it is clear that the presentation of educational programs within Extension will be changing. The computer has found a home.

WAYS TO USE COMPUTERS IN EXTENSION

Computers can be used in many ways and settings to assist consumers with financial concerns. Within Extension, there is the opportunity to work with clientel through one-on-one conferences; one time only or a series of small or large group meeting(s); displays at large gatherings; and mass media presentations. In Pennsylvania, we have used all of these forms of contact. Since Extension is an educational unit and not a one-on-one counseling service, most of our time is spent with groups. The programs that we are developing can be used by agents in group settings or in one-on-one counseling sessions; as a stand alone presentation or in conjunction with other educational programs such as my co-worker Marilyn Furry's learn-at-home series - "Families Managing in the '80's."

To present programs to large groups, we use a video projection unit and a regular screen. The size of our audience is determined by the available screen size. Several brands of video projection units are available including Aquastar, Electrohome, Inflight and Sony. The Agricultural Engineering staff at Penn State made our non-portable Aquastar portable. The video projector is in such great demand that the schedule is full several months in advance.²

Our financial programs are being used by other agencies such as the Council on Aging for one-on-one volunteer counseling. The programs have been demonstrated on statewide television via Penn State's PBS station. The viewing audience was given the opportunity to have their own situation analyzed. Exhibits featuring the programs

²The Pennsylvania Cooperative Extension Service does not endorse any commercial products.

have been set up at the Pittsburgh and Philadelphia Home Shows, the Pennsylvania Farm Show (our version of a state fair), Ag Progress Days, and numerous malls.

Clientel who try one of our financial management programs think the staff can also answer questions about purchasing computers. For that reason, some of our staff have had training in talking with clients about purchasing computers. At our displays, the clientel can sign up for further information including learn-at-home lessons on financial planning and information on purchasing a home computer.

FINANCIAL ISSUES THAT LEND THEMSELVES TO COMPUTERS

In the area of financial decision making, computers can be of great help but there are some problems they do better than others. Computers are suited to:

- 1) problems that are logical, involving an easily understood sequence of steps that reach a final solution;
- 2) problems that when given the same inputs will develop the same outputs; and
- 3) problems that benefit from increased speed of calculation, data retrieval or both.

The problems that are suitable for computers include: the cost of driving an automobile, the cost of food items per year, calculation of total interest on a loan, and budget analysis programs.

Problems poorly suited to the computer are those that require intuition and judgment or that have multiple answers to the same inputs. An example of such a program might be one that picked out your clothes or computed when you should trade automobiles. It would be very hard for a programmer to develop the correct logic for such a program because of the judgment and intuition that are involved in these problems. Another type of problem that is unsuited to the computer is a program that costs more than its possible benefits.

FINDING, ADAPTING AND DEVELOPING PROGRAMS

When Glyn Boone, my programmer, and I started, we did not have the development process ironed out. Our first educational program was a trial by fire, we did everything wrong. We have since produced a computer flowchart or map that diagrams the development process in a series of operations. Since producing the flowchart, we have tried to carefully follow the process as outlined (Figure 1).

To begin the process, try to pick problems suited to the computer; those that are logical, reach a specific conclusion, and benefit from increased speed of data manipulation. Start with small

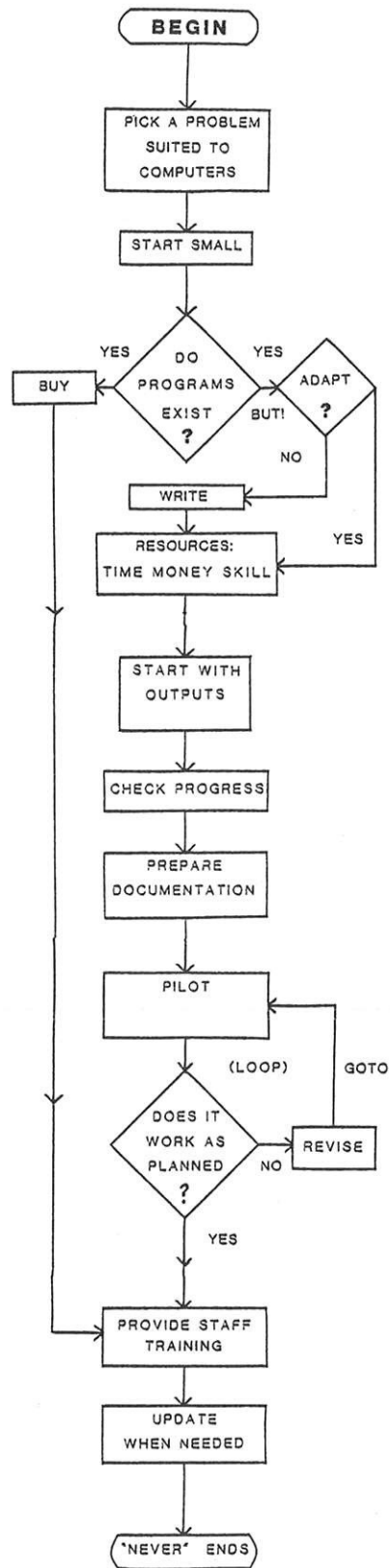


Figure 1. Development Process for Computer Assisted Financial Management Programs

programs until you have gained some experience in working with the computer and in developing educational programs to work in concert with the computer. Starting small allows you to build confidence in your own ability.

Computer programs for helping Extension clientele make financial decisions come from three basic sources: (1) purchased programs from commercial vendors and public institutions, (2) adaptations of pre-existing public domain programs, and (3) programs you write. One of the largest problems is finding existing programs.

Software directories and magazines articles can help in locating programs available for any purpose, type of computer, or operating system. The Strain Report (1984) lists programs available from Extension services in all fifty states. Those of us associated with land grant universities in the northeast and north central regions of the country can contact the Northeast and North Central Computer Institutes for help in locating programs.

If computer programs exist, they must be evaluated. Most educational programs have a narrow focus, use drill and practice techniques, focus on the recall of facts, and rarely use all the capabilities of the computer. Some programs that are suitable for classroom use are not useful for Extension.

In evaluating a program, you must look at content, instructional quality and technical quality. Points to look for in evaluating a program include: ease of operation, educational value, documentation, accuracy of the content, reliability in normal use and generalizability to a range of situations.³

If a program meets your needs and is available for purchase, I recommend purchasing. But what happens if a program meets some of your needs, but not all. Ask yourself a series of questions: Is it adaptable? Has the author not applied for a copyright? And, will the author grant permission for an adaptation? If you can answer yes to these questions, you may have found a program to adapt. Most of the programs we have chosen to adapt run on computers other than Apple II's.

Adapting or writing a program will require an experienced programmer. I can program but I am very slow. An experienced programmer can do in one hour what I do in eight. It is not cost-effective for the university to pay me to write programs. I recommend hiring an experienced programmer if you have the resources.

³For further information on evaluating computer programs, refer to: Evaluator's Guide for Microcomputer-Based Instructional Packages. Northwest Regional Educational Laboratory, 1981. ERIC (ED 206 330).

Writing or adapting programs requires two to four times the amount of time, money, and skill that you allocate for the process. If you set a deadline for having the program in operation, realize that it will probably be missed.

To write or adapt a program, start with outputs and reports, i.e., decide what you want on the screen and paper. Work backwards, define each screen, then refine it and add new elements. If needed, create new subprograms for additional reports. Write out everything you want the programmer to do, listing all formulas and data elements that are included along with all special instructions. As the programmer works, you will need to check progress frequently. A series of tests should also be prepared and used to find if the program works as designed. For example, in a loan calculator, all of the inputs and outputs for numerous loans should be calculated.

Remember, users do not know how you designed the program so they may decide to use the program in ways you never dreamed. Because of potential misuse and piracy of programs, we are including a disclaimer on every program. In essence, the disclaimer states we are not liable for any damage or loss which may result from the use of our software.

We have found that in many cases, we can use a spreadsheet program instead of writing a program in basic. The program we have just finished, "\$\$\$ and Decisions in the Supermarket," has taken about one year to complete. "\$\$\$ and Decisions in the Supermarket" (DDIS) was originally a mainframe program written by Mary Zehner and the Agriculture Economics staff at Michigan State University. We adapted it for use on a microcomputer; getting rid of the program's biggest disadvantage - a long distance telephone call.

As a check program for DDIS, I wrote a spreadsheet template that calculates the same costs. It took a little over three hours to write and can be typed into any model computer that can use VisiCalc or any similar spreadsheet. There are some advantages and disadvantages to using spreadsheet templates instead of writing a basic program. The major advantage of using spreadsheet templates is the saving of resources, i.e., time, money, and labor. Numerous spreadsheet templates can be produced in the same amount of time as one basic program. But templates have one major disadvantage, they are not easily used by the clientele. At many large exhibits such as Farm Show, we set up a bank of computers with several programs and invite passers-by to use a program. Extension personnel are there to explain the output of the program and present a mini-lesson. With templates, the program has to be run by our personnel which precludes giving clientele experience at the computer keyboard.

With any program, you must have excellent documentation. Much of the documentation I see is written by programmers who know how their program works but not how to write documentation. The

documentation is written based on the assumption that you know how the program works. When you have discovered how the program works, there is no need to read the now intelligible documentation. Each of the programs we have adapted comes with documentation.

As the program and documentation progress, it is time to start testing the program with groups. Each time we test a program, users find errors we have not seen. Users are not familiar with the program, so they try anything. We know how it works, stepping around all kinds of problems. It is not enough to test a program with just one group. Over the course of five one-day staff training sessions, we found a new error each day.

Staff training should not be overlooked. Staff have to feel comfortable with the program, know its assumptions, and how to explain the output or the program will never be used. Think you are done after training the staff? No.

The programs and staff need support and constant updates. Data within a program may change. Staff turnover mandates continual training. Staff members need support as they seek new ways to use the programs in their work. Updating programs and providing staff support are never ending cycles.

PENN STATE PROGRAMS

You might call the computer our gimmick for gathering people to listen to our messages about financial planning. In one way you are right, computers do draw crowds. But once people gather, we have a chance to present our message. Using the computer, we can quickly show an individual or family what happens when a small change is made in their spending and savings habits. Individuals usually tell us they want to learn more about money management, frequently signing up for a class or a series of learn-at-home lessons. Each time we set up a display with several computers, we have people standing five deep waiting to use a computer. The most popular programs are Auto Cost, Loan Calculator, Compute-A-Budget, and \$\$\$ and Decisions in the Supermarket.

\$\$\$ and Decisions in the Supermarket

"\$\$\$ and Decisions in the Supermarket" is our newest program. It was adapted from a mainframe program written by Mary Zehner, Steven Harsh, and Susan Chu at Michigan State University. The program calculates the annual cost of 19 categories of grocery items for a family or individual. It compares costs for different forms, brands, and package sizes. The program does not indicate the differences in nutrient values of grocery items. It only compares costs. A family's tastes will determine whether they can save money by changing forms, brands or package sizes.

Compute-A-Budget

Our financial planning program, "Compute-A-Budget," is popular when offered in a private setting. Since people don't wish to talk about their salary in public, clientel watching a demonstration of the program may fill out an input form and hand it to a staff member who will do the analysis at a computer that has been screened off from public view. Clientele may also mail in the input form; receiving an analysis within a week.

"Compute-A-Budget" is adapted from Speedy Spend, a mainframe and Radio Shack Model I, II, III program, written by Veronica Carmack and W.A. Tinsley at Clemson. The name of the program was changed because in the process of adapting it, several assumptions were changed. We also thought the original name gave the impression of speedily spending money, while the impression we wanted to convey was that of planning your spending and saving.

The program has two versions. The short version asks the client for six budget entries; the long for nineteen. The clients budget is then analyzed and compared to a national average. We plan to gather Pennsylvania data for the comparisons. The program as now set up is for middle to upper income families. With work on the part of the operator, the program can be used with families receiving subsidies.

Loan Calculator

"Loan Calculator" is similar to many other programs now available. For an amortized loan, the program calculates loan amount, interest rate, length of loan, or payment amount if three of these four inputs are known. A loan schedule can be printed out for the client.

Auto Cost

"Auto Cost" was adapted from a program written by A. Nelson Swartz at Texas A & M. Several states are already using this program. It calculates operating costs per mile and the annual cost of driving a car.

Templates Used

Several templates are available for use with spreadsheet programs. Many of the templates have been written by our field staff who are becoming experts at using a spreadsheet program. A few of the templates we currently use are: cash flow analysis, amortization table, net worth, tax forms, budget planning and food cost.

Future Programs

In the near future, we will be working on programs in the areas of insurance, savings, investing, small home business management, retirement planning, renting or buying a home, and time management. These programs will supplement areas of work we already have outlined in our five year

program of work. To find, adapt and develop programs, we will be following the development process as outlined in Figure 1.

CONCLUSION

The new technologies are changing the way Extension works. The ability to use a computer will soon be a requirement for every new agent. Those of us in the area of family resource management will be developing educational materials that can be augmented by the use of the computer. The financial issues we deal with are especially suited to the computer. Using the computer is a cost-effective and time-saving method for effectively introducing financial management concepts to large numbers of people.

In the future, most of us will not be programmers, just users. But we will be required to find and use computer programs to augment our educational materials.

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WHAT IS A COMPLETE DEMAND SYSTEM?

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Economists have developed theories of choice to provide frameworks for analyzing key elements in the consumer's decision making process. The usefulness of these models goes well beyond ivory tower economics, as they serve several extremely important functions. They comprise the structure for identifying the relevant variables associated with consumer choice, establish the marketplace conditions which are necessary for consumers to maximize their well-being, and comprise a rationale for public intervention in markets on behalf of consumers.

Models of consumer behavior have many applications that benefit consumers. This is especially true of those which provide estimates of the extent to which consumer demand changes as a result of changes in the economic environment. Resources can be utilized more efficiently by businesses having access to better forecasts of consumer demand. The impacts of public programs and policies on consumer demand can be estimated. And, these models can be used to assist consumers in making better purchase decisions.

Complete demand systems comprise a group of models which provides all of these desirable features. They are systems of demand equations that explicitly recognize simultaneity of consumer expenditures across the entire spectrum of consumer purchases. There are two properties which characterize a complete demand system. The first is the presence of a set of demand equations in which each equation represents a specific demand category. The second is that the sum of consumer expenditures across the categories must equal the money budgeted. Notice that the second condition gives meaning to the use of the word complete. All of the money budgeted must be allocated completely among the expenditure categories included in the system. Consequently, the opportunity costs of budgetary decision making is incorporated. That is, money used to purchase one good cannot be used to purchase another.

This paper is a non-technical discussion of complete demand systems. Comprehensive, technical presentations of these models can be found in the classic monograph by Goldberger [3], and more recently by Deaton and Mullbauer [1]. A conscious effort is made to downplay the mathematical derivations and properties of the models; and instead, indicate how the estimated models provide a great deal of insight regarding consumer responses to changes in the economic environment. The focus is on the application of the estimates to evaluate consumer responses. Emphasis, at present, is directed towards providing an overview of the basic properties of complete demand systems, and the other two papers in the session illustrate the use of estimated models.

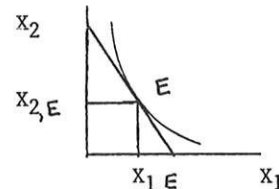
¹Associate Professor of Consumer Economics

CLASSICAL ECONOMIC THEORY

In general, a consumer's problem is the familiar one of maximizing utility subject to constraints. The traditional economic model reduces the economic environment in which an individual operates to the simplest choice situation. Although this model is an abstraction from the real world, it nevertheless has many desirable and realistic features. The constraint is a limited amount of money available to a consumer for purchases of market goods. Utility is derived from the use of the purchased goods; and so, the consumer's problem is to find that combination of purchases, or bundle, which maximizes utility. There is no possibility of borrowing or saving, because the consumer's expenditures must equal the money budgeted. Consequently, the analysis is restricted to a one-period time horizon.

Beginning students are introduced to the model with additional restriction that there are only two goods. This is done solely for the purpose of creating a two dimensional diagram. Utility is represented by the set of indifference curves; and given a budget and market prices, the budget constraint depicts the market opportunities. Figure 1 is a typical representation, and the familiar point of tangency associated with utility maximization is shown as bundle E. X_1 and X_2 are quantities of the two goods.

Figure 1
Utility Maximization



For present purposes, the key feature of this diagram is that the optimal consumption bundle, point E, identifies the quantities of both goods which the consumer purchases. They are $X_{1,E}$ and $X_{2,E}$. That is, the quantities which are purchased are determined simultaneously. It is impossible to do other wise. There is no way for the utility maximizing amount of one good to be determined without doing the same for the other good.

The two-goods model is very useful as a pedagogical tool. Not only does it permit a diagrammatic combination of consumer preferences and market opportunities to identify the optimal consumption bundle, but the diagram also permits a clear analysis of the effects of changes in the economic environment on the optimal bundle. Anything which causes the point of tangency to change leads to changes in a consumer's demand for the two goods. More precisely, preferences,

prices, and income are shown to be the determinants of the optimal bundle.

Information contained in the figure also can be represented mathematically. Utility is represented in equation (1) as a function of the quantities of the two goods, and the budget constraint is equation (2). Maximizing equation (1) subject to equation (2) is the equivalent of the consumer trading-off utility in relation to the relative price. The solution is the set of demand equations (3). Just as with the point of tangency in the figure, determinants of the quantities demanded are the prices of the goods, the money budgeted, and consumer preferences which are incorporated in the functional notation.

$$U = (X_1, X_2) \quad (1)$$

$$M = P_1X_1 + P_2X_2 \quad (2)$$

$$X_1 = f_1(P_1, P_2, M) \quad (3-1)$$

$$X_2 = f_2(P_1, P_2, M) \quad (3-2)$$

U = utility

M = money budget

P = market price

Extending this model beyond the two-goods world is straightforward. The utility function just has more goods which generate satisfaction, and there are more expenditures which must sum to the money budgeted. Letting n denote the number of market goods, the general form of the complete demand system is derived through maximizing equation (4) subject to equation (5). The solution is equations (6)

$$U = (X_1, X_2, \dots, X_n) \quad (4)$$

$$M = P_1X_1 + P_2X_2 + \dots + P_nX_n \quad (5)$$

$$X_1 = f_1(P_1, P_2, \dots, P_n, M) \quad (6-1)$$

$$\vdots \quad \vdots \quad (6-n)$$

Notice the complete demand system accounts for the simultaneity of consumer decision making. Just as one set of conditions determine the point of tangency in a two-goods world, one set of conditions on the right-hand side of equations (6) determine quantities which are purchased. The optimal bundle defined by equations (6) is the result of the consumer simultaneously juggling all purchases so as to maximize utility. The opportunity cost of money spent on one good is that it cannot be used to purchase another, and market prices set the trade-off.

The simultaneity can be seen in another way. Any change in income or the market price of a good affects all purchases. Each demand equation contains all prices and income, and the functional notation embodies preferences, in the absence of an explicit utility function. Two extremely important implications are associated with equations (6). One is that any attempt to estimate demand equations should be within a systems context, not on a single equation basis. Second, the analysis of consumer responses to a changing economic environment needs to account for the interrelationships among demand categories.

To illustrate the second implication, the best way to evaluate consumer oriented public policies

is to examine their impacts across the entire spectrum of consumer demand. Imagine a tax of 3 cents per gallon on gasoline has been proposed. Not only is gasoline demand affected, but so are consumer purchases of food, clothing, etc. The complete demand system approach is a way of accounting for these interactions.

ELASTICITY AND COMPLETE DEMAND SYSTEMS

Elasticity is a conventional economic measure of the strength of a causal relationship between two variables. With respect to demand analysis, interest centers on consumer responsiveness in terms of the percentage change in the quantity demanded or the percentage change in expenditure due to a percentage change in a specified independent variable such as income or price. The motivation for using percentage changes is to transform the data into pure numbers, so elasticities can be interpreted in a uniform manner.

A complete demand system can be manipulated to express the relationships as elasticities. This basically involves expressing variables in percentage terms, utilizing some differential calculus. The appendix to the paper indicates how this is done. Letting lower case letters denote percentage changes, equations (6) become the elasticity relationship's shown as equations (7).

$$X_1 = e_{11}P_1 + e_{12}P_2 + \dots + e_{1n}P_n + h_1m \quad (7-1)$$

$$X_n = e_{n1}P_1 + e_{n2}P_2 + \dots + e_{nn}P_n + h_nm \quad (7-n)$$

e_{ij} = the effect of a percentage change in the j^{th} price on the i^{th} percentage quantity demanded

h_i = the affect of a percentage change in income on the i^{th} percentage quantity demanded

General theoretical restrictions and the specific form of the utility function impose mathematical constraints on the set of elasticities. Since these constraints are imposed during the estimation process and our focus is on the use of the estimated elasticities, the mathematical constraints are not discussed here. Often, the estimated elasticities are presented as a table. Table 1 shows such an arrangement for equations (7).

Table 1
Elasticity Matrix

P_1	P_2	...	P_n	M
e_{11}	e_{12}	...	e_{1n}	h_1
\vdots	\vdots		\vdots	\vdots
e_{n1}	e_{n2}	...	e_{nn}	h_n

Very specific directions of causality are assumed. Percentage changes in a specific independent variable, or column heading, generate percentage changes in the quantities demanded, or row heading. The e_{ij} are price elasticities, and the h_i are income

elasticities. Additional independent variables could appear as columns (depending upon the model). In most instances there are socio-demographic variables. With respect to the e_{ij} , whenever i equals j , it is called an own-price elasticity. Otherwise, the e_{ij} are cross-price elasticities. This means that the principal diagonal of the price elasticity matrix, the first n rows and columns of Table 1, are own-price elasticities and the off-diagonal elements are cross-price elasticities.

CONSUMER DEMAND AND POLICY EVALUATION

The inherent simultaneity of consumer purchase decisions is represented clearly in equations (7) or Table 1. Any change in price or income has an effect on consumer demands for each of the categories, measured by the respective elasticities. This would also be true for other variables if they were part of a specific model, because they would appear as additional columns in the table.

Columns and rows are related in well defined ways based upon a mathematical analysis. These relationships are imposed during the estimation process and ensure a theoretically consistent set of estimated parameters. No single equation or ad hoc estimation procedure is capable of doing this. Therefore, the complete demand system approach serves as an excellent vehicle for examining the relationships among consumer demand categories. Moving down a column of the table is the equivalent of tracking consumer responses across demand categories due to a percentage change in the respective column heading. Moving across a row is the equivalent of tracking how the demand for a specific category is affected by each of the independent variables in the system.

Comparing various elasticities can reveal a great deal about consumer behavior. The income elasticity column indicates how percentage changes in consumer income are likely to be distributed across goods. Inspection of the own-price elasticity diagonal reveals which categories are most, or least, responsive to own-price changes. Comparing price elasticity columns suggests which prices have the largest, or smallest, impact on consumer demand across the board. For example, one column could have cross-price elasticities which are farther away from zero than any other column. This result would imply that percentage price changes in this good have the greatest overall impact on the percentage changes in the quantities demanded. Similarly, that row which has elements which are typically larger (smaller) than any other row is most (least) affected by across the board percentage changes in the independent variables. An illustration of this is a study by Eastwood and Craven [2].

Complete demand systems offer a very useful tool to forecasters and policy analysts through the ability to track the effects of a change in the economic environment across goods. To illustrate, suppose an agricultural policy

is proposed which would have the effect of raising the price of poultry 5 cents per pound. How would this affect consumer demand? Clearly, the impact extends beyond the poultry market, as consumers could substitute many other foods. Furthermore, other categories of consumer demand could be affected. One way of handling this situation is the complete demand system approach. A very disaggregate demand system for the food sector could be used to forecast consumer responsiveness for various food items and a more aggregated demand system could be used to forecast impacts in other sectors. The other two papers presented in this session are more specific illustrations of how to use complete demand system estimates. One is based upon the traditional static setting and the other is a dynamic model.

APPENDIX

A typical functional demand equation is

$$X_i = f_i(P_1, \dots, P_n, M)$$

The total differential is

$$dX_i = \frac{\partial X_i}{\partial P_1} dP_1 + \dots + \frac{\partial X_i}{\partial P_n} dP_n + \frac{\partial X_i}{\partial M} dM$$

$$\frac{dX_i}{X_i} = \frac{\partial X_i}{\partial P_1} \frac{dP_1}{X_i} + \dots + \frac{\partial X_i}{\partial P_n} \frac{dP_n}{X_i} + \frac{\partial X_i}{\partial M} \frac{dM}{X_i}$$

$$= \frac{\partial X_i}{\partial P_1} \frac{P_1}{X_i} \frac{dP_1}{P_1} + \dots + \frac{\partial X_i}{\partial P_n} \frac{P_n}{X_i} \frac{dP_n}{P_n}$$

$$+ \frac{\partial X_i}{\partial M} \frac{M}{X_i} \frac{dM}{M}$$

$$\kappa_i = e_{i1} p_1 + \dots + e_{in} p_n + h_i m$$

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COMPLETE DEMAND SYSTEMS: THE STATIC MODEL

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ABSTRACT

This paper describes in non-technical terms the static model for a complete demand system. The results from the static model in terms of elasticities are discussed. The interpretation of the elasticity matrix and how this information is used to assess and project changes in the complete system are presented.

Recently, much attention has been devoted toward determining a better way of modeling consumer behavior through the use of alternative formulations of complete demand systems. However, earlier applications which received some notice for their contribution to the understanding of food demand in the United States include studies by Brandow [1] and George and King [2]. Since the previous presentation in this session describes the complete demand system, the focus here will be only on the static model as it forms the basis for analyzing or examining specific problems and issues.

Note should be made that while there are several procedures for estimating the complete demand system, the use of partial demand systems has been quite prevalent in estimating, by single and multiple equation, formulations which do not explicitly include all parameters that simultaneously represent the complete system. More specifically, the partial systems have involved the estimation of relationships for part of the universe of parameters with the *ceteris paribus* condition being imposed on the remaining parameters; i.e., all parameters not included in the partial system are assumed to remain unchanged. While there are conditions under which partial systems have been and will continue to be useful in estimating demand relationships, the mention here is only to bring this method of estimation to your attention and to indicate that the literature is replete with partial system estimation (e.g. [5]).

The static complete demand system is just as the name implies -- it does not account for adjustments in consumer behavior over time but represents a given set of static conditions. To provide some insight into results provided by estimation of a static complete demand system, illustrations discussed will rely primarily on a study reported in Haidacher [3] and Haidacher, et al. [4], although other studies could serve the same purpose. Absent from this discussion will be any assessment of the models used or the reliability of parameter estimates obtained directly or derived from the models. Hence, the

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emphasis is to provide understanding of how consumers, individually or in the aggregate, respond to changes in specific parameters, namely, price and expenditure (income). The illustration of this response is in terms of elasticity which is simply defined for the purpose of this paper as the percent change in quantity of an item as a result of a one percent change in the price of any item in the system, or a one percent change in expenditure (income).

ILLUSTRATIONS OF THE STATIC COMPLETE SYSTEM

At the risk of being somewhat repetitious of the preceding paper in this session, the illustration of a demand elasticity matrix is presented in Table 1 to describe specific relationships which hopefully will aid in the understanding of subsequent illustrations. The elasticity (E) in the matrix represents a measure of the effect of a change in price or expenditure (income) on the quantity of the item(s) of the matrix. The on-diagonal elasticities (E_{FF} , E_{DD} , E_{NN}) represent own-price elasticities and the off-diagonal elasticities (e.g. E_{FD} , E_{NF}) represent cross-price elasticities. For example, the effect of a change in the price of durables (P_D) on the quantity of durables is represented by its own-price elasticity, E_{DD} , and on the quantity of food, and nondurables/services by the cross-price elasticities of E_{FD} and E_{ND} , respectively. The effect of a change in expenditure (income) on the quantity is represented in the last column of the matrix by the expenditure (income) elasticities for each item. Hence, the own-price, cross-price and expenditure (income) elasticities represent the relationships between price and quantity, and expenditure (income) and quantity for a complete demand system.

Table 1. Demand Elasticity Matrix, Three Goods, Complete System

Quantity Item	Price			Expenditure (Income) (Y)
	Food (P_F)	Durables (P_D)	Non-durables services (P_N)	
Food	E_{FF}	E_{FD}	E_{FN}	E_{FY}
Durables	E_{DF}	E_{DD}	E_{DN}	E_{DY}
Nondurables/services	E_{NF}	E_{ND}	E_{NN}	E_{NY}

Source: [4, p. 8]

Only a segment of the total matrix of elasticities for a complete demand system is

presented in Table 2. Although not explicit, other elasticities in the system were derived but not included in Table 2. As in the example of Table 1, the own-price, cross-price and expenditure (income) elasticities are reported in Table 2. Several comments can be made regarding the elements of the matrix to aid the understanding of consumer response.

Table 2. Compensated Elasticity Estimates: An Example^a

Item	FAH	FAFH	CLOTH	HOUS	OTH ^b	EXP
FAH	-.1602	.0056	.0050	.0341	--	.3648
FAFH	.0098	-.3023	.0105	.0710	--	.7598
CLOTH	.0125	.0149	-.3897	.0905	--	.9686
HOUS	.0172	.0205	.0183	-.4323	--	1.3293
OTH ^b	--	--	--	--	--	--

a. Based on [4, p. 10] and a procedure for the compensated estimates. FAF - food at home, FAFH - food away from home, CLOTH - clothing, HOUS - housing, OTH - other, EXP - expenditure (income).
 b. Estimated in [4, p. 10] but excluded from this example.

The derived elasticities are of the expected sign, i.e. own-price elasticities are expected to be negative, and the cross-price and expenditure (income) elasticities are expected to be positive. In the case of the own-price elasticity for food at home, the estimate of -.1602 represents the percent change in consumption of food at home in response to a one percent change in the price of food consumed at home. If, for example, the price of food at home increased by 10 percent, the consumption of food at home would decline by 1.6 percent. The own-price elasticities for all items are inelastic, i.e. have an absolute value of less than one. Since the own-price elasticity of housing (-.4323) is larger in absolute value than the own-price elasticities for the other items, it is said to be more elastic, i.e. more responsive to price changes. The cross-price elasticities (off-diagonal) represent the substitution effect of changes in price on quantity of each item purchased. In the example, the substitution effects are relatively small for all items. The largest cross-price effect occurs between housing and clothing where a 10 percent increase in the price of housing results in less than one percent (.009) increase in the quantity of clothing. Although this example of highly aggregated groups of commodities exhibits highly inelastic cross-price elasticities, it is expected a priori that a disaggregation of any of the items would yield more elastic cross-price elasticities.

The expenditure (income) elasticities in Table 2 reflect a range from .3648 for food at home, referred to as being inelastic with a value of less than one, to 1.3293 for housing, referred to as being elastic with a value equal to or greater than one. The relatively inelastic food at home component is viewed as being a necessity, whereas, the relatively highly

elastic housing component is considered a luxury relative to food at home. A luxury item is more responsive to a change in expenditure (income) than a necessity item. For instance, housing is more than three and one-half times as responsive to a change in expenditure (income) than is food at home. Hence, the consumer on average would reduce the amount of housing in a greater magnitude than the amount of any other item in response to a reduction in income.

The elasticities in Table 2 can be translated into a format which reflects consumption changes among the various items included in a complete demand system (Table 3). Since the elasticities in Table 2 depict the quantity-price relationship, its application is necessarily referred to as quantity consumed. This obviously presents a problem when individual commodities are aggregated into different groups. Huang and Haidacher [6] suggest that a quantity index may be constructed by dividing various consumer price indexes into their corresponding expenditures. In this study, the composite quantity indexes are computed by dividing consumer price indexes into respective personal consumption expenditure indexes. The composite quantity indexes for 1982 are shown in the first column of Table 3. Three scenarios are presented to show the effect of changes in expenditure (income) and price on the quantity of each item in a segment of the complete system. In the scenarios in which price is assumed to change, the budget constraint, total expenditure (income), is assumed to remain constant. In scenario I, total expenditures are assumed to increase by five percent. The change in composite quantity indexes resulting from a five percent increase in total expenditure ranged from an increase of 1.9 percent for food at home to an increase of 6.7 percent for housing. Scenario II assumes a five percent decrease in the price of food at home which results in relatively small changes in the composite quantity indexes among the items.

Table 3. Personal Consumption Expenditures, Selected Items, Base Year 1982 and Alternate Scenarios^a

Item	Base Year 1982	Scenario		
		I ^b	II ^c	III ^d
		----- index ^e -----		
Food at home	123.5	125.8	124.5	123.6
Food away from home	147.1	152.7	147.0	147.3
Clothing	162.4	170.3	162.3	156.1
Housing	139.2	148.5	139.1	139.5
Other	--	--	--	--

a. Estimates for scenarios are based on elasticities in Table 2.
 b. Assumes a 5 percent increase in total expenditures.
 c. Assumes a 5 percent decrease in the price of food at home.
 d. Assumes a 10 percent increase in the price of clothing.
 e. Composite quantity index (1967=100).

Based on the elasticities of Table 2, the price decrease is reflected in an increase in quantity index for food of .8 percent and a small decline for each of the other items. The third scenario assumes a ten percent increase in the price of clothing which decreases quantity index for clothing by 3.9 percent. Because the other items are substitutes for clothing, the increase in the price of clothing results in an increase in composite indexes for other items.

APPLICATIONS AND IMPLICATIONS

The static model has made valuable contributions to the understanding of the complete demand system even though certain assumption and constraints may have subjected the results of the model to be questioned. Particularly the more recent introduction of dynamics into the model has provided for additional comment on the static model. Since the dynamic models have been generally extensions of static models, procedures are available to determine if an improvement in the estimation of consumer behavior has occurred. A caveat perhaps should be issued to remind us that the application of any model is dependent upon the availability of data which adequately represents consumer behavior. But it should be noted that the data sets that have been used, primarily government generated time series, provide the basis for the estimating parameter which describe consumer behavioral relationships.

From the previous section of this paper, the applicability of the static model for estimating the relationships in a complete demand system can be viewed. First, the estimates of the relationships (elasticities) provide the basis for describing the effect of each parameter included in the system. It is important to gain some understanding of the manner in which these parameters influence the quantity of an item (good) purchased by consumers. Specifically, the illustration shows the extent to which price and income affect each item purchased and how these items may be categorized, ranging from necessities to luxuries. Second, the estimates provide the basis for evaluating projected changes in the system, either induced within the system or induced artificially into the system. The prior induced change would occur, for example, from changes in prices, income or other factors within the system. The latter artificially induced change could occur, for example, as a result of government intervention through programs which changed the price level or quantity of an item, or interfered otherwise with the system. In either case, the change could be traced through the system to determine the effect on each item within the complete system. For instance, from Table 2 and 3 it can be seen that an increase in income would result in an increase for all items but a relative

shift from the necessities of food at home towards housing, a relative luxury within the system. By contrast, a percent change in price would generally have a smaller effect on quantity of each item purchased. While the illustrations view individual changes affecting the system, several changes which occur simultaneously could be incorporated into the system. Specifically, the model could be used to simulate conditions in which alternative projected changes could be evaluated.

CONCLUSIONS

This paper provides a non-technical description and application of the static model for estimating a complete demand system. The importance of elasticities and how they are interpreted within the system were discussed. The usefulness of the results from the static model were illustrated. Hence, this exposition is intended to have provided a degree of understanding of how the estimates derived from the static model can be used to describe consumer behavior. For those interested in the more technical aspects of the static model, a body of literature exists for their perusal.

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ABSTRACT

This paper focuses on adjustment, habit, and inventory features of consumer behavior models. The paper provides a justification of dynamic demand systems, a description of various methods to incorporate dynamic structures into demand systems, and empirical examples of the application of the two popular dynamic models.

Consumer behavior patterns, consequently, may be more adequately represented by processes of gradual adjustment to changes not only in the economic environment but also to changes in tastes and preferences (Blanciforti, 1982). The application of dynamic demand systems emphasizes the role of time in empirical analysis and consequently overcomes the deficiencies of the static demand systems approach. Dynamic models are predicated on the hypothesis that consumers rely on past experiences to influence current decisions. The effect of past experiences is assumed to be represented entirely by the current values of certain "state variables" of which inventories and habits are concrete examples (Houthakker and Taylor, 1970). Subsequently, these "state variables," notably physical or psychological stocks, themselves are in turn changed by current decisions. In sum, current behavior depends on all past values of the predetermined variables, though more on recent values than on very remote values. With this distributed lag process, it follows that the impacts of changes in income and/or prices can be analyzed into short-term effects and long-term effects. Distributed lags, a weighted distribution of past values, have been utilized to take account of the effect of past events on present and subsequent periods.

Introduction

Particularly in empirical demand analysis, the application of complete demand systems is in the early stages of development. Much of the literature pertaining to complete demand systems has only been written during the last three decades.

The first paper of this session, by Eastwood, formally deals with the description of complete demand systems. The second paper, by Raunikaar and Huang, concerns the description of static demand systems. This paper constitutes a non-technical description of dynamic demand systems. In brief, dynamic complete demand systems provide information on adjustment, habit, and inventory features in consumer behavior patterns. The objectives of this paper are fourfold: (1) to justify the application of dynamic demand systems, (2) to describe methods to incorporate dynamic structures into demand systems, (3) to describe various types of dynamic demand systems, and (4) to provide empirical examples.

Justification of Dynamic Demand Systems

Demand systems are static in the sense that consumers, by assumption, adjust instantaneously to new equilibria due to changes in income (total expenditure) or prices, while all other factors including tastes and preferences remain constant. In reality, consumers neither react immediately to changes in prices or income (Koyck, 1954; Nerlove 1958) nor do tastes and preferences remain the same over time. In conjunction with this latter point, Pollak (1978) has suggested several reasons why tastes and preferences can be considered to be endogenous: (1) habit formation wherein tastes and preferences are related to past decisions of consumers, (2) interdependent tastes and preferences, that is, tastes and preferences related to the consumption patterns of others, and (3) the role of advertising to influence the tastes and preferences of consumers.

The theoretical and empirical foundations for dynamic demand systems have to be credited to Houthakker and Taylor (1970), Pollak (1970), and Philips (1972). The application of dynamic demand systems accounts for adjustments that occur through time due to habit persistences or stock adjustments. Consequently, dynamic demand systems are veritable extensions of static models. However, while the application of static demand systems is in the early stages of development, the application of dynamic demand systems is in the embryonic stage of development.

Methods to Incorporate Dynamic Structures Into Demand Systems

Attempts have been made to incorporate dynamic structures into demand systems. Habits and inventory features of consumer behavior are not as easily quantified or measured as prices and income. To model habit persistences and stock adjustments in consumption analysis, several approaches have been taken by analysts. The various approaches to achieve this end can be classified into three general categories (Hassan, Jonsson, and Green, 1977): (1) ad hoc procedures, notably the use of trend terms, (2) use of dynamic utility functions, and (3) use of a control theory format.

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The first approach, which represents different degrees of sophistication, entails various ad hoc procedures. The most rudimentary procedure involves the addition of trend variables to the demand equations as derived from the classical static theory (Powell, 1966). Although the underlying theoretical justification for the inclusion of time or trend variables is lacking, the objective is to reflect changes in tastes and preferences as well as socioeconomic factors through the trend term. A second similar approach involves the introduction of trend terms into the parameters of models (Stone, 1954). As with the additive trend terms, the underlying theoretical justification for the inclusion of the variables is lacking. While adding such terms may improve the performance of the estimated demand systems, the results obtained are limited with respect to structural considerations.

A third procedure included in this ad hoc category is the state adjustment model of Houthakker and Taylor (1970). This model rests on the assumption that quantities purchased depend on existing stocks - either physical stocks of goods (e.g. durables) or psychological stocks of habits (e.g. food). Although this venerable model explicitly considers the influence of past consumption behavior on current consumption patterns, this procedure is limited in the sense that it still does not introduce these factors into an integrated utility maximizing framework. Thus, an underlying theoretical structure which incorporates habit formation and inventory adjustment into the model is lacking.

The second approach to the problem of incorporating dynamic structures into demand systems entails the use of dynamic utility functions. Utility functions are made dynamic by directly embodying habit effects and inventory or stock adjustments. According to Pollak and Wales (1969), Pollak (1970), and Manser (1976), any utility function can be extended to allow for habit formation and stock adjustment by specifying that certain parameters depend on past consumption. The quadratic model of Houthakker and Taylor (1970) and the dynamic linear expenditure systems of Philips (1972) are illustrative of this approach. However, these models are myopic because the allocation of current expenditure is assumed to be influenced by past consumption, but the effects of the allocation of current expenditure on future preferences are ignored. Though the utility functions are indeed dynamic, the sequential decision-making of consumers is non-optimal.

The final approach to the problem of incorporating dynamic structures into demand systems entails the integration of both past and future considerations into the consumer choice problem. The problem, cast into a control theory format, is such that the consumer maximizes a discounted utility function subject to wealth and stock constraints. The stock constraints refer to habit formation and inventory adjustments. The models developed by Philips (1974), Lluch (1974), and Klijn (1977) are exemplary of the more general attempts to model

the sequential consumption decision problem. Consequently, this approach encompasses intertemporal formulations of the consumer demand problem. This intertemporal approach treats both the consumption-saving decision and the allocation of expenditure decision subject to wealth and stock constraints.

All three approaches, particularly the latter two, pose difficult measurement and estimation problems. Much of the empirical work in incorporating dynamic structures into demand systems has progressed along the lines of ad hoc procedures, notably the state adjustment model of Houthakker and Taylor, as well as the use of dynamic utility functions, notably the dynamic linear expenditure system of Philips.

Types of Dynamic Demand Systems

This section describes in moderate detail two popular dynamic demand systems: (1) the state adjustment model, and (2) the dynamic linear expenditure system. This description, however, omits several other important demand systems. For example, habit and inventory effects have been introduced in the translog demand system (Christensen, Jorgensen, and Lau, 1975) by Manser (1976), as well as in the Almost Ideal Demand System (Deaton and Muellbauer, 1980) by Blanciforti (1984).

The state adjustment model is given by

$$q_{it} = \theta_i + \alpha_i s_{it} + k_i m_t + v_i p_{it}, \quad i=1, \dots, n. \quad (1)$$

where q_{it} is the rate of demand of commodity i at time t , m_t is the rate of income (total expenditure) at time t , p_{it} is the relative price of commodity i at time t , and s_{it} is the stock of commodity i at time t . The variable s_{it} may be viewed as either a physical stock (in the case of durable goods) or a psychological stock (in the case of habit-forming goods). The terms θ_i , α_i , k_i and v_i are the underlying structural parameters for the various commodities in question. According to the interpretation of the model (Houthakker and Taylor, 1970), $\alpha_i > 0$ for psychological stocks and $\alpha_i < 0$ for physical stocks.

The greater the physical stock of commodity i , ceteris paribus, the less purchased in the current time period. Consequently, the stock coefficient, α_i , is negative for physical stocks. On the other hand, consider the case of commodity i of which consumers do not generally hold physical inventories of any significance (e.g. food). Additionally, current consumption is typically positively influenced by consumption in the recent past due to the fact that consumers do not adjust immediately to changes in income or prices. In this case, consumers possess psychological stocks of habits. Consequently, the stock coefficient, α_i , is positive for psychological stocks. The more consumed of commodity i in the past, the more consumed currently, ceteris paribus.

To round out the state adjustment model, assume further that

$$\dot{s}_i = q_{it} - \delta_i s_{it}, \quad (2)$$

where \dot{s}_i denotes the rate of change in the stock of commodity i , and δ_i is a constant non-negative depreciation rate. This expression relates the rate of change in the stock to the rate of purchase and the depreciation rate. This expression corresponds to the macroeconomic relationship that net investment is equal to gross investment minus depreciation. Also, this expression is based on the assumption that s_{it} depreciates at a fixed exponential rate (Philips, 1972).

Together, expressions (1) and (2) constitute the state adjustment model. For empirical implementation, the model is modified to circumvent the problem that s_{it} is unobservable. This problem can be avoided by solving expression (1) for s_{it} and using expression (2). The short-run derivatives of consumption with respect to income and price are given by k_i and v_i , respectively. Long-run derivatives are obtained by assuming that $\dot{s}_i = 0$, implying that the stock adjustment has reached an equilibrium state, with the quantity incurred equal to the product of the depreciation rate and the stock of the commodity. The term θ_i refers to autonomous consumption levels. The term, $\delta_i - \alpha_i$, carries the label reaction or adjustment coefficient.

The dynamic linear expenditure system is an extension of the static version. In the static version, the linear expenditure system is derived from the Klein-Rubin or Stone-Geary utility function given by

$$U = \sum_i \beta_i \log (q_{it} - \gamma_i), \quad i=1, \dots, n \quad (3)$$

where q_{it} is the quantity of commodity i at time period t and the β 's and γ 's are the underlying structural parameters. In the dynamic version, the parameter γ_i is assumed to be related to the non-measurable physical or psychological stocks according to the linear function, $\gamma_i = \theta_i + \alpha_i s_{it}$. The terms θ_i and α_i are also underlying structural parameters, similar in interpretation as in the case of the state adjustment model. The effect of past behavior is represented by the current values of certain state variables s_{it} . Again, $\alpha_i > 0$ for psychological stocks and $\alpha_i < 0$ for physical stocks.

By introducing the assumption given by expression (2) and by redefining expression (3) on the basis of the substitution for γ_i , the demand functions for the dynamic linear expenditure function are derived by maximizing the utility function subject to the traditional linear budget constraint. To derive the long-run demand functions, it is assumed, similar to the situation in the state adjustment model, that $\dot{s}_i = 0$. Again, the reaction of adjustment coefficients are equal to $\delta_i - \alpha_i$.

In both models, the effects of past behavior is represented by the state variables s_{it} as well as by the assumption given in expression (2). Psychological stocks (habits) that develop as a consequence of past behavior are very much like physical stocks which analogously emerge from past purchases. The state adjustment model is a directly specified dynamic demand system, while the dynamic linear expenditure system emerges from the maximization of the redefined Stone-Geary utility function.

Empirical Examples

This section serves to illustrate the application of the state adjustment model and the dynamic linear expenditure system. The purpose is to demonstrate the adjustment, habit, and inventory features of dynamic models. This empirical illustration features the work by Green, Hassan, and Johnson (1978) and concerns the structure of consumer behavior in Canada for the period 1947-72. The principal application of the demand models is to consumer expenditures disaggregated into four groups: (1) durables, (2) semi-durables, (3) non-durables, and (4) services.

Estimates of the structural parameters and elasticities for the state adjustment model are exhibited in Table 1. There are two negative and two positive stock coefficients. Durable and semi-durable goods with values for α_i less than zero are subject to inventory adjustment, while non-durables and services with values for α_i greater than zero are subject to habit formation.

Table 1. Structural Coefficients and Elasticities for the State Adjustment Model

	Commodity Group			
	Durable Goods	Semidurable Goods	Nondurable Goods	Services
Structural Coefficients				
θ	47.28	173.44	372.36	63.14
α	-.393	-.065	.350	.360
k	.3928	.1728	.1392	.2092
v	-261.85	-96.56	-255.88	-119.17
δ	.301	.103	.813	.690
ρ^a	.694	.168	.463	.330
Elasticities				
Income	SR 3.30	SR 1.19	SR .42	SR .52
	LR 1.43	LR .73	LR .74	LR 1.19
Price	SR -1.31	SR -.35	SR -.43	SR -.13
	LR -.57	LR -.21	LR -.76	LR -.31

^a $\rho = \delta - \alpha$

Estimated values for the δ_i 's indicate rates of depreciation from .103 for semi-durables to .813 for non-durables. Non-durables and services, psychological stocks, depreciate at faster rates than durables and semi-durables, physical stocks. The higher depreciation rates for the non-durable and service groups reflect a lack of strong persistence of habits. For example, in the case of non-durable goods, the rate of .813 implies a more than 95 percent depreciation by the end of two years and a more than 99 percent depreciation by the end of three years. For durable goods, in contrast, the rate of .301 implies a more than 90 percent depreciation by the end of seven years.

The reaction or adjustment coefficients, $\delta_i - \alpha_i$, are between zero and one in every case, indicating a Nerlovian partial adjustment mechanism for the state variables. Consequently, the reaction coefficients reflect the proportion of adjustment model to long-run equilibrium after a single time period. To illustrate, for durable goods, 69.4 percent of the adjustment made to long-run equilibrium occurs after one year, whereas for semi-durable goods, only 16.8 percent of the adjustment occurs after one year. For each of the commodity groups, the short-run income coefficient k_i is positive and the short-run price coefficient v_i is negative. In every case, the "autonomous consumption level" θ_i is positive, with larger values for semi-durables and non-durables than for durables and services.

The own-price and income elasticities of demand have the anticipated signs. For durable and semi-durable goods, the short-run income and own-price elasticities exceed the corresponding long-run measures. The converse is true for the short-run and long-run elasticities for the non-durable goods and services commodity groups. Short-run refers to the instantaneous adjustment in consumption before the state variables have a chance to take effect. Long-run refers to the full adjustment in consumption including any indirect effects through changes in state variables. This result is consistent with Houthakker and Taylor rationalizations for inventory adjustment and habit formation. For physical stocks (durables and semi-durables), the immediate effect of changes in income or prices is to change the stock. In subsequent periods, the higher (lower) stock tends to decrease (increase) the flow of purchase. For psychological stocks (non-durables and services), although consumers respond to changes in income and prices in the short-run, the magnitude of the response is greater (in absolute value) in the long-run. In sum, in the short-run, consumers are more sensitive to changes in income or prices for physical stocks than for psychological stocks. In the long-run, consumers are more sensitive to changes in income or prices for psychological stocks than for physical stocks.

Estimates of the structural parameters and elasticities for the dynamic linear expenditure system are exhibited in Table 2. All of the estimated β 's are positive, indicating decreasing

marginal utility for each commodity. With the exception of services, the estimates of the stock coefficients and the estimates of the depreciation rates are very similar for the state adjustment model and the dynamic linear expenditure system. The reaction coefficients are, except for semi-durables, larger in the dynamic linear expenditure system than in the state adjustment model. With the exception of durables, all autonomous consumption levels are lower in the dynamic linear expenditure system than in the state adjustment model. Although the income elasticities for the commodity groups in question are notably similar, salient differences, particularly for semi-durables and services, exist with respect to the own-price elasticities. All in all for the demand models, there exists substantial agreement among the estimates for structural parameters and elasticities.

Table 2. Structural Coefficients and Elasticities for the Dynamic Linear Expenditure Model

	Commodity Group			
	Durable Goods	Semidurable Goods	Non durable Goods	Services
Structural Coefficients				
δ	.306	.104	.909	.870
β	189.12	70.19	79.56	99.59
α	-.484	-.043	.304	.514
θ	72.65	157.36	210.04	16.93
ρ^a	.790	.148	.605	.355
Elasticities				
Income	SR 3.13	SR 1.11	SR 0.53	SR 0.60
	LR 1.09	LR 0.71	LR 0.71	LR 1.33
Price	SR -1.44	SR -0.67	SR -0.41	SR -0.49
	LR -0.89	LR -0.63	LR -0.62	LR -0.97

$$^a \rho = \delta - \alpha.$$

Concluding Comments

This paper focuses on the extension of models of the structure of consumer behavior to dynamic settings. The paper provides a justification of dynamic demand systems, a description of various methods to incorporate dynamic structures into demand systems, a description of the state adjustment model and the dynamic linear expenditure system, and empirical examples of the application of the state adjustment model and the dynamic linear expenditure system. Given that dynamic demand systems provide information on adjustment, habit, and inventory features in consumer behavior patterns, additional theoretical and empirical research on this topic is likely to pay large dividends.

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ACCI CONSUMER EDUCATION WORKSHOP

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INTRODUCTION

The increasing complexity of the decisions adult consumers must make in the marketplace requires an educated, alert and responsive consumer population. The marketplace of today includes the world and the consumer population must be able to analyze current issues, identify and evaluate relevant information and formulate reasoned judgements harmonious with the individual's goals and those of society. Yet the preparedness of adults in the United States, one of the most complex and sophisticated of all markets, is severely deficient. In a well-recognized study of adult functional competency one-fifth of the population was deemed "functionally incompetent" while a second fifth of the sample was deemed "barely competent" (4, p. 2). The major area of difficulty reported was in the area deemed consumer economics.

If the preparedness of adults is then so poor, perhaps part of the error is the general neglect of consumer and economic education until the secondary school level. While attempts have been made to emphasize consumer and economic education in the elementary grades, a notable example being the efforts of the Joint Council on Education, the more common emphasis remains focused on the secondary level. Yet waiting until a student reaches the secondary level or even junior high may be too late. A study on children's perceptions of the symbolic meaning of a product or brand revealed that by 6th to 8th grade students had already formulated impressions quite similar to those held by college-age students and adults (5, p. 316).

Greater discussion about consumer education at the elementary and even pre-school level needs to be done. Such a discussion should focus on consumer education content, teaching methodologies and research data.

CHILDREN AS CONSUMERS

From the time the toddler first inserts his penny into the gumball machine that child begins his consumer training. As Dr. James McNeal has written children are consumers from an economic viewpoint because they have desires, wants and needs and the ability to purchase so as to satisfy those needs (3). "A potential consumer is an individual who possesses

purchasing power and a desire for a product or service" (#6, p. 10). By the age of seven years the child in McNeal's study possessed the minimum qualifications of a consumer, that is that he exhibited independence in purchasing and viewed money as a necessity for acquiring goods. From both a psychological and sociological perspective children are viewed as consumers. Children possess the cognitive abilities to express their needs in the marketplace and certainly marketing techniques attempt to utilize the psychological needs of children. As a part of developing in our society children perform activities collectively termed the "consumer role", for example many nursery schools and kindergartens have a "store" in the classroom and children accompany parents into stores where they influence a variety of purchases.

Yet it is not easy for an elementary teacher to tap resources for teaching in the areas of consumer and economic education. In a comparative analysis study of consumer and economic education, the researchers observed that it was necessary to collect a broad range of elementary materials in order to identify materials having the concepts for economic and consumer education (7). These researchers further noted that, "Each individual piece of published material for elementary students covered only a few of the concepts included in the model (11) (7, p. 11). The majority of elementary teachers already burdened with their required curriculum would be unable or unwilling to develop extensive programs or lessons in the consumer education area.

A second concern about children as consumers is the lack of research data on children as consumers except for certain highly publicized areas. This point was made some twenty years ago, "Despite the generally accepted belief that childhood experiences often influence adult behavior, the child as a consumer trainee has received little attention from researchers (#6, p. 2). A review of research utilizing children as the sample respondents for subject matter areas covered by consumer education revealed extensive research investigating various aspects of the relationship between advertising and children. Another cluster of studies was found on the amount of money children spend and for what products although this research is frequently proprietary. Only scattered research reports were found, however, for the many other subject matter

areas of consumer education. A small number of studies have investigated why children buy what they do and how they fulfill the consumer role (3). This lack of research needs to be addressed.

A related research concern involves the application of research findings. It has been demonstrated that a short instructional unit can produce significant increases in children's cognitive awareness and cognitive defenses capable of resisting commercial influence (2). In this study on the question of believability of advertisements the attitudinal defenses of the eight year old children receiving the instruction equaled those of eleven and twelve year old students. The concern, however, is that research results do not become readily available to the group most qualified to apply them, namely the elementary teacher. These research findings must be made available to teachers and assistance given the teachers in devising the lessons to utilize the information.

The major purpose of the "Kids are Consumers, Too!" workshop was to explore different subject areas of consumer education with elementary school teachers; included also was a summary of the research which utilized children as respondents in each of the subject matter areas and possible teaching methodologies.

CURRICULUM AND AUDIENCE ASSUMPTIONS

The definition of consumer education and appropriate content areas for consumer education have been a source of concern for a lengthy period of time. Considerable confusion and overlap between consumer education and economic education have been and continue to be of concern. The workshop, however, proceeded upon the broad idea of:

"Consumer education is the process of gaining the knowledge and skills needed in managing consumer resources and taking actions to influence the factors which affect consumer decisions (1, p. 5).

A number of assumptions about the curriculum were made before the subject areas were chosen for the workshop. Foremost among these was that appropriate processes as well as subject matter content had to be covered, for example the teaching of skills to locate, process, interpret and use data (8). The processes involved in inquiry, valuing, decision-making and taking action were to be heavily stressed. A second assumption was that educational objectives for each subject area had to be incremental so as

to move a student from a low level of proficiency to higher ones. The consumer education content also had to be presented so teachers could perceive of ways to integrate the material into existing classes.

An additional consideration was that the 5 most necessary concepts in consumer education were: planning; consumer resources; borrowing; values; and goals. Those deemed most necessary in economic education and therefore to be covered in that area were: factors of production; markets as settings; price as resource allocator; the U.S. economy as mixed market; and the market system (10, p. 6). In the workshop, economics was covered as a subject matter area separate from that of personal finance.

The final consideration in selecting subject matter areas was that the topics had to be ones appropriate for the maturity and ability levels of students across the eight grade levels and permit multiple learning approaches of varying degrees of difficulty. Because it was impossible to know in advance what mix of elementary teachers would be attending the workshop, it was necessary to develop a minimum of two objectives for each subject area for each grade level. Work done by the state and city offices of curriculum and instruction was particularly helpful in developing these objectives (9).

A number of assumptions about the participants was made in planning the workshop. The first was that the adults involved in the workshop would bring to the workshop varying levels of consumer knowledge and skills but would have given little prior thought about organizing this knowledge and teaching in the areas. A second assumption was that the elementary teachers would not have had any previous coursework in consumer or economic education and life experiences would provide most of their knowledge about the consumer role. It was also assumed that the adults would have limited awareness of the field of study designated as consumer education and therefore, have limited awareness of the history and development of the consumer movement. It was assumed that because of the foregoing, the teachers would have difficulty in identifying and collecting materials and/or resources in the areas of consumer education and have limited awareness of current research on children as consumers. Finally, it was assumed that the teachers would be receptive to learning and teaching in the area of consumer education and would therefore desire material that could be relevant to both classroom instruction and their private lives.