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Introduction and Summary *

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NATIONAL PLANNING ASSOCIATION

I. NEW RESEARCH ON THE BEHAVIOR OF THE CONSUMER SECTOR

THE research presented in this volume explores for the most part the observable market and nonmarket behavior of consumer units in terms of the more basic consumer objectives—objectives which can explain their choices in allocating resources among the currently purchased goods and services; between current and future consumption, investment, and leisure; and between health and personal safety and income. It explores in some detail the relationships between the particular characteristics of certain goods and services and objectives which the consumers seek to achieve by means of these goods and services. It also addresses some questions of consumer safety and information in the context of optimization through market and nonmarket processes, and includes a discussion of statistics of consumption.

The microeconomics of consumption has long been a dormant subject in economic research, perhaps because in the past the prevailing view of consumption ignored the specifics of the consumption process as distinct from expenditure.

This volume is the first in the present series to have consumer behavior as its main focus. Though, to be sure, individual papers given at the various meetings, both recent and early, addressed particular questions of consumer behavior and consumer welfare, none of the earlier meetings had the behavior of the consumer sector as its principal theme.

The present wave of research on the household sector has been given direction by the deepening and extensions of the theory of con-

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sumption[1] and has built on the empirical foundation provided by the hedonic price analysis.[2] Also, various social changes, including the recent growth of the consumer movement, have placed the consumer sector closer to the center of public and professional attention.

The insights afforded by the research discussed here suggest that the goods and services which consumers purchase or use can be seen as tractable inputs devoted to the achievement of personal and household objectives. Consumer behavior can be better understood in terms of specific functional relationships and objectives which goods and services and their combinations can serve by virtue of their particular properties, given the limits of consumer income, time, and other resources. The papers in this volume convey, I believe, a clear sense that the various consumer units tend to behave as competent producers in a large variety of situations often thought to be governed by irrationality or impulse responses.

The papers display a great diversity of research methods and subject matter. The subjects include determination of family size; interrelationship between education and health; allocation of work between present and future income; wage differentials in risky jobs; detailed analyses of consumption of food, automobiles, and housing; product safety; evaluation of product quality; and aggregate consumption statistics. These subjects are examined by means of a variety of research techniques including cross-sectional and sequential econometric models; benefit-cost analysis, dynamic optimization, index number analysis, estimation of utility functions, and demand analysis for product characteristics.

The papers presented in the course of the Conference are the result of a rather systematic search for advanced research in the field of consumption and household behavior. It is impossible to say how well we succeeded in representing the ongoing research, but a serious attempt in that direction was made. Two topics for which we unsuccessfully tried to find ongoing research are the role of public goods—or, more generally, of collective goods—in the consumption process, and the

[1] Gary S. Becker, "A Theory of the Allocation of Time," *Economic Journal* 75 (September 1965): 493–517; Kelvin J. Lancaster, "A New Approach to Consumer Theory," *Journal of Political Economy* 74 (April 1966): 132–157; Idem, *Consumer Demand* (New York: Columbia University Press, 1971); Robert T. Michael and Gary S. Becker, "On The New Theory of Consumer Behavior," *Swedish Journal of Economics* 75 (1973): 378–396; Richard F. Muth, "Household Production and Consumer Demand Functions," *Econometrica* 34 (July 1966): 699–708.

[2] Zvi Griliches, ed., *Price Indexes and Quality Change* (Cambridge: Harvard University Press, 1971).

interpersonal aspects of the decision processes occurring within households. Also, none of the papers deals with sources of consumer preferences or of changes in these preferences.

The first part of the volume, *Demographic Behavior of the Household,* deals with aspects of household choice of family size and with production of health. Of the two papers on family size, one reflects a cross-section model concerned with the optimum family size, and the other attempts to identify a sequential model when the decision on having one more child is considered. The health production paper is based on a recursive model, exploring the interrelationship between schooling and health.

Papers in the second part, *Market and Nonmarket Aspects of Real Earnings,* deal with two questions regarding the labor market behavior of individuals. The first paper considers the individual's allocation of working time between current income and investment in future income. Methodologically, it represents a model of dynamic utility maximization. The second paper estimates the market price of avoidance of job-related deaths, based on an analysis of wage differentials in risky occupations. The underlying model of the demand for and the supply of job safety treats jobs as multi-characteristic objects of transactions.

The third part, *Level of Aggregation in Consumption Analysis,* deals with differences and similarities of individual market goods and their characteristics. The papers explore a basic problem of consumption research: determining the appropriate level of aggregation in the definition of consumer goods and in the measurement of their prices.

One paper extends hedonic analysis by developing a two-stage estimating model for component prices of automobiles, adding a stage oriented toward performance characteristics to the one based on technical specifications. Another paper estimates cost-of-living indexes based on the parameters of eight distinct utility functions which permit substitution among goods in order to test the reliability of conventional consumer price indexes, which are based on an implicit assumption of no substitution. The third paper contains an estimation of price indexes for the components of housing, based on price estimates of detailed characteristics derived from a sample of observed price variations in a large number of houses sold within a local market over a period of time.

Papers in the fourth part, *Measurement and Policy Issues in Consumption Analysis,* deal with selected aspects of measurement of

product quality and their applicability to particular policy issues. One paper discusses the measurement of risk and the setting of safety standards for consumer products, identifying relative costs and benefits of prevention of risk by consumers versus reduction of risk by producers, and illustrates the analysis by a case study. Another paper describes a subjective evaluation approach to measuring overall quality of consumer goods and retail outlets. The third paper develops a long-term quantity-consumed index of Canadian consumption, compares it with the conventional series of deflated value of consumer expenditure, and computes a residual describing the difference between the two series.

II. DEMOGRAPHIC BEHAVIOR OF THE HOUSEHOLD

Michael and Willis consider the household behavior regarding determination of family size. The authors focus on the choice of contraceptive techniques and calculate the probability distributions of conceptions as a function of the choice of techniques and the efficiencies with which they are used. Given the monthly probability of conception, the total number of children born to a couple would be determined by the length of the fertile life-span and other biological parameters. Thus, family size becomes the dependent variable, simply derivable from the monthly conception probability variable.

In the authors' model, the utility of parents depends on the number of children, the "quality" of children (which depends on the amount of time, attention, and expense which can be devoted to each child) and on other outputs of the household production processes. Its maximization is subject to lifetime income and time constraints. Given the couple's preference field, there exists an optimal number of children for the family, and deviations in the direction of excess fertility or deficit fertility reduce utility. Because the actual outcome of fertility control behavior is stochastic, utility increases can also be expected from reduction of the variance of fertility. But fertility control techniques have rising costs and consequently, for any given couple, different techniques are optimal for different family sizes. The higher the contraceptive cost, the less control will be desired, and the larger the resulting family size. The fertility control costs include not only money but also time, loss of pleasure, sacrifice of moral principles, risks to health, and other factors.

In estimating the relationships between contraception techniques used and the fertility outcome, Michael and Willis use cross-section survey data from the 1965 National Fertility Survey of 5,600 married

women, grouping data by religion, race, age, and wife's education. They find substantial differences in the family size and in the estimated relationships between groups. Within homogeneous groups, they find a negative relation between fertility and the use of effective contraceptive methods. Holding other variables constant, they also find a reduction in the variance of fertility with increasing levels of wife's education.

Finally, the authors undertake a case study of the use of the pill, restricting the data to white non-Catholics and using subsamples for women who began their first, second, and third pregnancies, respectively, in 1960. They find positive effects on the use of the pill for the time trend, husband's income, wife's education, and the occurrence of prior contraceptive failure; and a negative effect for wife's age at marriage.

Rottenberg finds himself in agreement with Michael and Willis regarding their formulation of questions and their research strategy, which postulates that no contraceptive strategy is certain, that all are costly, and that households differ in their contraceptive effectiveness. He also agrees that the behavioral implications of this theory are not contradicted by the tests. Then Rottenberg points to what he considers are two shortcomings of the Michael-Willis model: it assumes that services and utility derived from children can be obtained only from own children, and treats time as a homogeneous entity.

In raising a few specific points, he argues that the data do not permit distinctions between pure and mixed contraceptive strategies, and that the fixed costs of contraceptive alternatives may be overweighted. He questions the inference that changing contraceptive techniques is uncommon, and he argues that differences in preferences rather than in the time horizon may perhaps provide a more likely explanation of why use of the pill by women married at an older age is less prevalent than it is among women who were younger when married.

Heckman and Willis develop an econometric model of fertility behavior within a sequential stochastic framework. The building of a family is viewed as a stochastic process described by a number of states with respect to fecundity and pregnancy and by the transition probabilities between these states, which depend on contraception among other things. Behavior is determined one month at a time, and the generalized equation for the expected utility is stated in terms of utility of preventing the conception of the $n + 1$st child, in month t.

In practice there are substantial components in statistical variation not included in the model. These arise from differences in health and in

taste for sexual activity, as well as from differences in contraceptive efficiencies. These unmeasured components, Heckman and Willis note, pose very serious statistical problems in obtaining unbiased estimates of the effects of economic variables on the monthly probability of conception. They discuss the serial correlation problems which arise from the unmeasured variables which are assumed to be randomly distributed among individuals, but which maintain consistent levels for specific individuals over time. The authors derive estimates of the monthly probability of conception in the first pregnancy interval following marriage. The data consist of a sample of white, non-Catholic women, married once, with husband present for fifteen to nineteen years, and it is taken from the National Fertility Study for 1965. Heckman and Willis have analyzed the history of contracepting and noncontracepting couples for a maximum of 120 months, beginning with the first month of marriage. They have then proceeded to study the effects of independent variables, including wife's education, wife's age, and husband's predicted income at age 40.

Next, they have estimated the parameters of their model and the magnitude of the serial correlation. Wife's age turns out to be the only significant variable affecting probability of conception in the noncontracepting sample. Among the contraceptors, the effect of the economic variables is neither significant nor entirely trivial. Heckman and Willis convert their estimates of parameters into estimates of monthly probabilities of conception and eliminate the effect of serial correlation, which was significant. In testing the economic variables, they find, somewhat to their surprise, a substantial negative effect of husband's predicted income on completed fertility, while there is some indication of a slight positive effect of wife's education.

McFadden finds the theoretical model of Heckman and Willis very interesting and their statistical methods new and powerful. He observes that the statistical methods employed by Heckman and Willis constitute a break with tradition and provide a new method for research. He finds it particularly appropriate that instead of postulating a representative consumer who is choosing a divisible time rate of consumption, the model recognizes that the population is heterogeneous and that the number of children has to be integral. The paper introduces components of variance structure between families and within families over time.

McFadden wonders, however, whether the empirical analysis provides sufficient tests for the theory, and whether the questions raised actually lend themselves to the type of economic analysis the authors

apply. The significant empirical result is that the economic variables do not explain the monthly probability of pregnancy. McFadden points out that the authors' model distinguishes only between contracepting and noncontracepting families, but some studies suggest that the socio-economic factors may influence family size through their effects on the choice of particular contraceptive techniques. He cites results from one such study showing more pronounced effects of these factors.

Grossman undertakes to explore statistically the relationship between health status and schooling. Grossman conducts econometric analysis by the application of a theoretical model he develops. In his model, health is treated as a stock of capital which is increased by investment and reduced by depreciation. Health is viewed as capital primarily determining the amount of time available to an individual. The knowledge capital produced by schooling determines the productivity of working time in the market and in the household, including time spent in production of health. Grossman discusses a recursive system of equations with schooling dependent on health and health dependent on schooling. The system is specified in three equations describing the demand for children's health, for schooling, and for adult health.

Grossman tests his model on the NBER-Thorndike-Hagen sample based on the data for the Army Air Corps cadets of 1943, who were reinterviewed in 1955 and in 1969, with a supplementary survey in 1971. Because this sample deals essentially with upper income and educational groups, the effect of schooling on health that can be examined with this data actually represents the effect of attending college. Health is measured by a self-evaluation response, but the indicator Grossman derives from it correlates with data on work-time lost.

Grossman finds that a year of school contributes about 1 per cent to the index of health, other variables held constant. Since past health is among the variables held constant, this effect presumably represents a causal relationship from schooling to health. He also finds a positive effect of wife's schooling on the husband's health. In the schooling equation, past health has a statistically significant, though not very large, effect on the years of school completed. Among other relationships explored, Grossman examines the mortality experience of the NBER-Thorndike-Hagen sample and finds a positive correlation between schooling and survival rates.

Usher discusses Grossman's model of the demand for health. He takes issue with the treatment of health expenditures as investment,

arguing that many health expenditures are costs of present ill health and preconditions for preservation of life, not investments in future health. He suggests that the model is facing a paradox in the observed positive correlation between medical expenditure and occurrence of illness. Secondly, Usher questions measurement of health in units of illness-free days. He criticizes Grossman's formulation of the relationship between the state-of-health stock and the flow of illness-free days, which does not permit identifying the stock of health. Usher suggests that Grossman's empirical work probably could stand on its own, regardless of the model used, but that he would have preferred a dynamic to a static model.

Grossman, in his reply to Usher, argues that his model can accommodate negative correlation between medical care and health through an increase in the rate of depreciation, raising the shadow price of health and reducing the quantity of health capital demanded. If the depreciation rate were held constant, Grossman argues, the correlation would be positive, but because it is not held constant, the gross correlation is negative. He points out that his model can be used for defining separate demand curves for preventive and remedial medical care.

III. MARKET AND NONMARKET ASPECTS OF REAL EARNINGS

Heckman presents a model which attempts to explain the allocation of human time among work, investment, and leisure. He notes that the analysis of this subject encounters not only mathematical difficulties of dynamic models with finite time horizons, but also statistical problems, because the underlying union of the labor supply theory and the human capital theory introduces an unobservable statistical variable, i.e., work time spent investing.

In his model, Heckman assumes a utility function dependent on quantities of goods and leisure consumed at different times, a time preference rate, a budget constraint depending on the time path of hours worked, wages, and prices of consumer goods. The model also includes a conceptual division of time on the job into work and training time. Optimal investment behavior, from which the estimates of the investment time are to be derived, cannot be specified from the general model without making a series of very explicit assumptions about the model, functional forms, and values of parameters of the human capital investment. Heckman assumes a Cobb-Douglas production function for human capital and proceeds to simulate investment

profiles based on the wage data. He uses synthetic cohort data, from the 1970 Census tape for white, college-educated, employed males not in school, age 23 to 65. Hourly wage rate is calculated by dividing earnings by the estimated hours worked.

Heckman develops a number of simulation models. In one model, human capital is excluded from its own production and the rate of depreciation is set at zero, while the interest rate is fixed at 10 per cent. This model yields an estimate of time spent investing which declines more or less continuously from some 25 per cent of the time at work in the market at age 23 to near zero at age 50. Since market hours increase early in the working age, the absolute amount of invested time remains constant until the early thirties and then declines until age 50. Heckman finds a sharp increase in investment time immediately after school, which contradicts the simplified model. He consequently drops the assumption of zero depreciation and zero effect of human capital on its own productivity and estimates the corresponding parameters directly. The estimated rate of depreciation is quite small, a fraction of 1 per cent, while the amount of human capital seems to have negative effect on its own production. This unconstrained model also gives much steeper decline in the time spent investing, from 30 per cent immediately after school to near zero around age 35. Heckman concludes by noting that his estimates for both models yield steeper decline in the proportion of time spent investing at each age than the amounts assumed earlier by other researchers.

Schultz finds the analytical reasoning in Heckman's paper very interesting and persuasive but raises questions about the empirical treatment. First of all, he objects to the use of synthetic cohort data in estimating a large number of parameters in a highly complicated model, especially since some time series data for individuals and actual age cohorts are becoming available. He also raises some points about specific maximum likelihood estimations. He is skeptical about the interpretation of the parameters obtained by Heckman. Even with all the restrictions made in the model in order to identify the time allocated to future income, Schultz argues, the testable empirical implications are not powerful in accounting for anomalous empirical evidence, such as a negative productivity of human capital and the jump in investment time after school.

Thaler and Rosen analyze wage differentials in risky jobs, in order to estimate the implicit market price of the avoidance of risk of death. They view safety and wage as two characteristics of jobs. Thaler and Rosen consider the workers to be selling labor, while at the same time

purchasing nonmonetary aspects of jobs (safety); and assume firms to be purchasing labor, as well as selling the same nonmonetary aspects. In the theoretical model, which generalizes Adam Smith's concept of equalizing differences, the equilibrium wage differentials for risky jobs will be determined by the demand and supply functions for safety. The authors proceed to develop a theoretical model for cases of multidimensional risks (different injuries not comparable) and for different preferences in risk aversion among workers. Because their empirical work uses data for very risky jobs, the authors caution that their estimates of demand prices for safety may be lower than those applicable to average workers.

In their empirical estimation, the authors study a sample of male heads of households from the data in the 1967 Survey of Economic Opportunity for worker characteristics and wages, and they match this data with the risk data from the 1967 Occupation Study of the Society of Actuaries, which examines about 3 million policy years of worker experience, tabulated by occupation, over the period 1955–1964.

This actuarial data measures additional risks associated with certain occupations which are particularly hazardous, as revealed by insurance company records. The wage data the authors use is a weekly wage. For characteristics variables held constant, the authors use the regional and urban location variables, as well as personal characteristics including age, family size, race, education, and income. They also attempt to control for job characteristics by using variables representing unionization and the type of industry. With these variables, the authors estimate a number of different equations, which yield varying estimates of the actuarial equilibrium price for avoidance of one job-related fatality ranging, in 1967, from $136,000 to $260,000. This price is interpreted as the intersection of the demand curve for safety by workers and the supply curve of safety by firms.

Kosters notes that the actuarial data used by Thaler and Rosen reflect not only the risk of death on the job but also differences in the risk of death associated with characteristics of workers in various occupational categories. Their conceptual framework permits the authors to make a careful distinction between the price concept, for which they are making estimates, and the concepts involved in the demand curves for safety of the individual workers or in the cost curves of risk reduction for individual firms.

Lipsey argues that the data used by Thaler and Rosen actually measure the extra risk to the insurance company of insuring those who

enter a particular occupation, rather than true occupational risks. He then points out that the associated mortality risks will not be compensated by higher wages, except to the extent that there is a correlation between risks inherent in jobs and characteristics of persons in the jobs. Consequently, the estimated coefficients for compensating wage variations are subject to bias.

IV. LEVEL OF AGGREGATION IN CONSUMER ANALYSIS

Triplett, in his role as session chairman, discusses the framework within which research on this topic is conducted. He argues that it is important to close the gap between "New Demand Theory" and empirical work on hedonic quality measurement, but he also argues that some recent attempts to do so have seriously misstated the problem to be attacked. To help illustrate his points, Triplett offers a simile comparing goods of nonhomogeneous quality, which are the object of hedonic price analysis, to preloaded grocery baskets. Under his simile, rather than placing their wares on the shelves with unit prices marked on them, the grocers have, instead, loaded various assortments into grocery baskets, attaching prices only to each of the preloaded baskets as a whole.

The hedonic research represents an attempt to find out what the prices would have been had the groceries been stocked on the shelves. Central to this research is the concept of the hedonic function, which Triplett defines as a regression in which a vector of market prices of different varieties of a product is related to a matrix describing product characteristics of these varieties. Hedonic functions cannot be derived either from preferences or from production functions, because the hedonic functions do not correspond to the demand functions, but rather to portions of budget constraints.

Ohta and Griliches present a study of automobile prices which extends the hedonic approach by distinguishing between the physical characteristics of a car and its performance variables. They postulate a two-stage hypothesis which asserts that physical characteristics of a car produce its performance. They address the question of whether the performance variables explain enough of the variation in prices to permit their substitution for the physical characteristics in hedonic regression.

The basic model relates the price of a given car, new or used, to its make, physical specification characteristics (hedonic components), and age, in a form where depreciation rates vary with make. Five physical characteristics are used: shipping weight, length of the car,

maximum brake horsepower, a dummy variable for the body type, and a dummy variable for the number of cylinders. The authors study the depreciation patterns in order to establish whether the make effects persist in the used car market. They also test whether the imputed prices of physical characteristics are stable across firms and over time.

The authors find distinct make-effects which persist through the used car markets, suggesting that these are not transitory markups by manufacturers for new cars. The make-effects are greater in the used than in the new car markets. Depreciation rates, using a declining balance method, differ by make and by model year, suggesting that the hedonic method did not fully capture the vintage effect. The price of the high-priced cars is not fully explained by the physical characteristics. They conclude that the imputed prices of physical characteristics are stable over time and between makes, and that new and used cars are essentially the same good, differing only in the quantity of the good contained in them for market use. The authors interpret the systematic price differences among makes as reflecting unmeasured aspects of quality, rather than simply being pricing errors.

The performance variables based on the *Consumer Reports* data, include among others, miles per gallon, acceleration, handling, trade-in value, and frequency of repairs. Ohta and Griliches find that the performance variables correlate about as well with prices as do the physical characteristics. Performance variables with strong explanatory power are correlated with physical characteristics, such as weight and horsepower or with depreciation rates (trade-in value), while those which are not highly correlated with measured physical characteristics are not statistically significant. Comparing physical characteristics with the performance variable improves the fit somewhat but not much. The authors find that the make-effects obtained in equations using performance variables are about the same as the make-effects obtained with physical characteristics. They conclude that both sets of variables tell essentially the same story, and that the two-stage approach did not contribute much.

The authors compare the hedonic price indexes derived by the two methods and find that they are essentially similar, and that both show about the same price increase for the period 1964–1971 as does the Consumer Price Index component for new cars. Used car prices rose relative to new car prices in the early 1960s; the authors interpret this as reflecting a possible decline in the quality of new cars in that period. From the hedonic indexes, they also conclude that quality

adjustments in the price indexes for new cars which treat pollution-control devices as quality improvements are not recognized as such by consumers.

Barzel notes that the selection of variables in a hedonic analysis, including the present one by Ohta and Griliches, is always incomplete. The results obtained represent a composite of the effects of the measured and of the unmeasured attributes, which would explain some of the unexplained variability. He also argues that the discontinuity in the characteristics causes discrepancies between hedonic and true cost-of-living indexes.

Ohta and Griliches, in replying to Barzel, argue that the conventional consumer price indexes are not necessarily better at complete enumeration than the hedonic indexes, and note that the hedonic indexes never aim at completeness but strive to include major variables, while permitting the rest to be included in the constant. Unless one can specify what has been left out, it is not possible to do anything about omissions. Regarding discontinuity and nonlinearity of price schedules, the authors acknowledge the seriousness of the problem but claim that it is one which afflicts all price indexes alike, with no special effect on the hedonic indexes.

Christensen and Manser construct a number of cost-of-living indexes for meat and for produce, using annual data for the period 1947–1971. Construction of cost-of-living indexes requires knowledge of the utility function representing consumer preferences. In practice, one must assume a particular utility function, estimate its unknown parameters, then use the estimates to construct a cost-of-living index. Specifically, the authors estimate the parameters of eight distinct utility functions, both for meat consumption and for produce consumption, and test the ability of these functions to explain the observed budget shares within these two groups of commodities. The translog function, the only one which does not impose either homotheticity or additivity restrictions on consumer preferences, explains the observed budget shares better than do the other forms. The different utility functions also imply quite different estimates of the price and expenditure elasticities. However, the authors find that the cost-of-living indexes computed with the translog utility function and with the other utility functions for meat and produce do not differ very much over the period studied. They also compute five price indexes using actual rather than estimated budget shares. They find that the Tornquist chain-link index which allows for substitution possibilities provides a somewhat closer approximation during the period covered to the true

cost-of-living index than do fixed weight or chain-linked Laspeyres or Paasche indexes. However, the magnitudes of the numerical discrepancies between the indexes actually were not very large, suggesting that, within the range of experience covered, Laspeyres indexes (the Consumer Price Index is basically a Laspeyres index) do not differ very much from a cost-of-living index which satisfies the more demanding theoretical requirements.

Taylor, in discussing the paper by Christensen and Manser, commends the authors for their choice of an important topic and for the technical accomplishment of their work. He considers use of the translog utility function to be an important innovation in the applied demand analysis. He also considers it noteworthy that in estimating cost-of-living indexes, the authors have, in their construction and estimation, used only the indirect utility functions (functions of total expenditure and the prices of all commodities) rather than the direct function of levels of consumption of the individual commodities. Taylor suggests that the subindexes derived for the two commodity groups have to be interpreted as conditional cost-of-living indexes (conditional on the given prices and quantities for all other goods in the consumer basket). Otherwise, deriving such subindexes would not be consistent with the theoretical framework used. Finally, he voices caution that there is an inherent and unsolved problem in calculating cost-of-living indexes from parameters that have been estimated using other price indexes.

King undertakes a study of housing demand in terms of the characteristics approach. He notes that most studies have treated housing as a homogeneous commodity, while in reality many characteristics of the dwelling itself, and of its location, are important in explaining prices and consumer choices. He proposes a model of housing demand which includes a model of the residential location choice, and in which the individual characteristics of the housing bundle have their own prices. The households in his model choose their location in a three-way tradeoff among commuting costs, neighborhood quality, and advantageous characteristics of the housing itself. He further postulates that a metropolitan area would contain a series of linked submarkets, each with its own hedonic price equation for prices of the components of housing characteristics, because the existing stock of housing is fixed and can change only slowly over time.

In his empirical application, King uses data for 1,800 single-family houses sold through the multiple listing service in the New Haven, Connecticut, metropolitan region from 1967 to 1970. King also con-

ducted a survey to collect data on such characteristics of the purchasers as income, family size, education, and place of work. He has also constructed two indicators of neighborhood quality by converting the ratings for a number of characteristics of neighborhood quality received in the questionnaire by means of a principal-components analysis.

Using political boundaries to define the boundaries of submarkets, King proceeds to derive hedonic equations for prices of housing components in which the price of the house in 1967 dollars is the dependent variable, and 31 hedonic components are the independent variables. He estimates a total of seven equations, one for each town and one for the area as a whole. King then aggregates the hedonic prices of the 31 components into prices of four characteristics of houses: basic structure, interior quality, interior space, and site. Expenditures for different components in his model can simply be added up into expenditure for a characteristic.

With these estimates of prices, King proceeds with the demand analysis, using a separable housing expenditure constraint (replacing the income constraint) and prices and quantities of the housing characteristics. With this analysis, he obtains distinct demand equations in price and housing outlay for the four characteristics, and elasticities for outlay—for own price as well as cross-elasticities. The results suggest that consumers indeed behave as if they were purchasing distinct bundles of characteristics. While this evidence suggests that purchasers behave as if they perceived the existing differences in the prices of characteristics, they do not tend to locate in the cheapest market because of location constraints. King finds that the simple tradeoff between housing price and commuting distance does not explain the departures from purchasing in the cheapest market, but by introducing a three-way tradeoff among commuting cost (distance), price of housing, and quality of neighborhood, he finds evidence that substantial tradeoffs were made between price of housing and quality of neighborhood.

King concludes by observing that an important heterogeneous good like housing can usefully be treated as a collection of specific characteristics. When analyzed in terms of characteristics, the behavior of prices and of consumers follows patterns consistent with economic rationality of choice, given income and prices.

Ingram agrees with King that the past studies treating housing as a homogeneous service have not been able to cope with the complexity of the characteristics of housing. He then discusses the variation in

prices among the submarkets, observing first that the variations are included in housing expenditures, thus presenting problems for housing expenditures used as a measure of quantity consumed. He notes that spatial specifications of characteristics prices resulting in spatially tied sales differentiate analysis of housing demands from that of most other consumer goods. Ingram observes that simply adding up the products of component prices and their quantities into characteristics imposes restrictions on the utility functions of consumers, since the consumers are required conceptually to be indifferent in choosing among the combinations of components which are included in the characteristics of a given value. He also notes that the method used by King—limiting household substitutions to choices within the submarkets—raises certain issues, and he suggests some theoretical alternatives. Ingram notes that in King's analysis, the quality of neighborhood emerges as an important determinant of household location choice, and he questions the appropriateness of combining it with other attributes of the site characteristic, rather than treating it as a separate attribute.

V. MEASUREMENT AND POLICY ISSUES IN CONSUMPTION ANALYSIS

Broussalian develops a formal criterion for identifying unreasonable hazards of consumer products, and illustrates it by a case history of refrigerator doors. Unreasonable hazard is defined as possible occurrence of an undesirable event in the course of normal use of a good, in circumstances where the expected cost of the event is greater than the cost of avoiding it. Costs are defined on the social cost basis, and the benefits of avoidance are monetized. Avoidance actions can be taken both by producers and consumers.

Full market competition would tend to provide optimal risk avoidance. However, the economy may tolerate the presence of unreasonable hazards under certain conditions, such as lack of risk-insurance markets, external effects on third parties, or high transaction costs.

Broussalian illustrates his analysis by one particular case in which a physical safety standard has actually been set in order to avoid death by entrapment in a household refrigerator. In this case, there was considerable time lag in the achievement of refrigerator safety, because of the lag in replacement of old models. In fact, the degree of its actual achievement is still uncertain.

This case points to the tremendous complexity of information required in order to increase product safety. The physical safety stan-

dards set for refrigerators are an example of risk avoidance measures taken by producers. Measures which could be identified as the consumer risk-avoidance actions include following the warning literature provided by the manufacturers or the governmental warning literature, and complying with state and local criminal codes and ordinances relating to abandonment and storage of refrigerators.

In attempting benefit-cost calculation for the refrigerator case, Broussalian observes that the benefits per refrigerator were quite small because fatal accidents are rare and the discounting period long. On the other hand, the costs of the magnetic door device which proved to be most effective for easy opening were practically zero. For that reason, the producer avoidance requirement imposed by law can be considered as reducing unreasonable hazard.

Broussalian argues for the need for specific theories of accident occurrence and for careful analysis and data collection in devising helpful safety measures.

Gould notes that, in practice, benefit-cost criteria impose very difficult measurement problems on the benefit side. In the present case, the measurement problems are aggravated because benefit measurement includes monetization of injury and of loss of life, and because identification of the marginal effects of the accident avoidance actions are required. Gould also points out two serious conceptual problems in Broussalian's model. One is an inherent and implicit interpersonal utility judgment basic to the estimation of cost. In Broussalian's model, the aggregate cost for consumers is obtained by summing across individuals the costs of accident avoidance activities to the individuals. The other problem arises from minimizing social costs, rather than maximizing social welfare. Broussalian holds the level of output constant, but the changes in the level of output resulting from the imposition of hazard-avoidance costs may affect the overall consumer welfare.

Maynes proposes a general concept of quality measurement and illustrates it with the local market data for sofa beds in Minneapolis. In his concept, he includes characteristics of both the product and the seller, and deals with quality in terms of a product-brand-dealer combination.

Maynes defines quality formally as an index based on a set of characteristics scores determined by testers and weighted by a set of weights assumed to reflect the importance of the individual characteristics. Maynes uses the quality index to deflate money prices and finds in his case study that the range in the quality-deflated prices

within his case sample is not much less than the range of the money prices. He further suggests that the informational effectiveness of markets can be measured by the price variation at a given level of quality, i.e., by the variation in the quality-adjusted prices.

Maynes points out that his measurement includes a cardinal scaling and requires an assumption that consumers would make uniform assessments of the quality characteristics and would attach the same weights to these characteristics. However, Maynes does not believe that it is possible to measure quality objectively, because quality is intrinsically subjective. Subjectivity persists, he continues, because different individuals in different circumstances, or with different tastes, would assign different weights, even if they all agreed on the characteristics.

Maynes also argues that because many different inputs are required to produce a given service, the definition of characteristics as services reduces the number of properties to be considered and makes measurement easier. Maynes cites automobile safety as an example where a number of specific physical properties such as stopping distance for brakes, tires, and so on have a bearing on safety, but the evaluators assess the safety characteristic as a whole.

Juster argues that there are basic flaws in the quality measurement approach that Maynes provides. He points out that whether the quality-adjusted prices show a large or only a small variation will depend largely on the scaling used to measure quality, which is itself arbitrary. It is possible to choose alternative scalings which would give very different results. If the price and the quality-scale indicator are perfectly rank correlated, then there is one way of scaling the quality indicator which will produce zero variation in the quality-adjusted prices, while other ways of scaling the quality scores of the characteristics would produce either positive or negative association between the original money prices and the quality-adjusted prices. However, if price and quality scales are not perfectly correlated, then it is not possible to find a scaling which will eliminate differences in quality-adjusted prices, and the resulting measurement would always suggest imperfect functioning of markets. But the absence of perfect rank correlation between price and quality indexes, Juster contends, could reflect interpersonal differences in the relative weights of characteristics. Therefore, in order to accept Maynes's inferences about the functioning of the markets from his quality measurements, it would be necessary to accept the scoring system he uses and the cardinal utility magnitudes inherent in it, and further to assume that there is

no variation among the population in the weights assigned to characteristics. Because of the problems of deriving comprehensive quality indexes which would satisfy such requirements or avoid such difficulties, Juster expresses doubt about the value of pursuing the search for broad-gauged indexes of average product quality.

Triplett contrasts Maynes's concept of quality as a product attribute which is inherently measurable by a nonmonetary scalar indicator with the concept underlying the hedonic method. The hedonic method requires no single measure of quality as such; rather, "quality" is understood as merely a shorthand reference to the quantities in a vector of characteristics. The value of the characteristics vector can be calculated as a single number, provided one can find appropriate implicit prices for the characteristics to use as weights. Triplett argues that the concept of nonmonetary quality is not necessary for analysis because the only measure one needs is a measure of the value of quality differences (which can be obtained via the hedonic approach). Moreover, Maynes's approach cannot resolve interpersonal differences in taste; in the hedonic approach, this problem need not be addressed.

In comparing data requirements for empirical implementation of Maynes's method with the hedonic method, Triplett notes that both the hedonic method and Maynes's proposal require measurement of quantities of characteristics; however, where the hedonic technique requires only that prices be also available for different varieties in order to estimate the prices of characteristics, Maynes's method requires information on the utility of characteristics. Triplett continues that until cardinal utility can be measured, Maynes's proposal cannot be implemented but, if cardinal utility could be found, then it would not be necessary to measure characteristics, because one could then measure the utility of the entire product directly. Since utility is not measurable, Maynes's proposal, in Triplett's view, reduces to ad hoc judgment and does not contain systematic scientific measurements.

Maynes, in replying to the discussions by Juster and Triplett, defends the usefulness of his approach by citing the generally accepted usefulness of the *Consumer Reports* published by the Consumers Union and the similarity of his method to that used by the Consumers Union's scoring system. He argues that the Consumers Union scoring system is cardinal, even though in textual interpretation the Consumers Union generally has acted conservatively and taken an ordinal posture. He further argues that the quality scoring system employed by Consumers Union conforms to his model, in which the weights are rela-

tive marginal utilities associated with a given characteristic as determined by the consensus judgment of the CU testers.

Usher offers a comparison of two personal consumption time series per capita, one derived by conventional deflation of the expenditure series by a consumer price index and the other derived by revaluation of the quantities consumed by base-year prices. He computes the two series for Canada for the period 1935–1968. There is a substantial difference in their growth, which he suggests can be viewed as an analytically useful residual, possibly reflecting changes in the quality of consumption.

Usher argues that while the deflated consumption expenditure series have certain obvious advantages, such as availability of data and capacity to account for product variety, the quantities-consumed series can also illuminate trends in consumption. Usher further argues that quantity data are more closely related to the arguments of utility functions and to the social-indicator concepts than are the value data. Quantity data may also help in sorting out the types of consumption which more closely correspond to improvements in welfare from those that reflect increased costs.

Usher has constructed for consumption commodity classes, and for consumption as a whole, a revalued quantity-consumed time series using detailed data for several hundred specific items of consumption at 1961 prices. The principal empirical result of Usher's calculations is that the rate of growth of real consumption per head based on deflated value data is much higher (at 2.8 per cent per year) over the long period 1935–1968 than the per capita growth of his time series of revalued quantity data (which grew at 1.8 per cent a year). The full 1 per cent a year differential, in Usher's view, reflects the implicit adjustment for quality change, as well as conceptual differences between the series and errors of measurement. Usher views his work as experimental, but he hopes that in the future, valuable insights into the relationship between consumption growth and economic growth will be gained as better and more detailed quantity data become available.

Reid agrees with Usher's offering of his series as a tentative exploration and would emphasize this fact. Reid notes that the quality residual that Usher calculates is subject to errors in the expenditure series, in the consumer price indexes, and in the quantity indexes. She also thinks that future stimulus for improvement of quantity estimates of products is more likely to come from their contribution to knowledge of demand and welfare of specific consumption series, rather than from demand for global information. She comments that Usher offers

little support for his argument that quantity indexes are more likely to be indicative of welfare than price-deflated expenditures, and also notes that none of the calculated aggregates or averages have a bearing on distributive changes. Reid also comments on the contribution to real consumption of the household economy, which Usher has not included. In view of past and future substitutions and shifts between household and market economy, quantity indexes which do not include the output of the household economy are likely to provide biased estimates of real consumption.

Mack, in her comment on the Conference as a whole, observes that the question of tastes and value systems has not been given much direct consideration. She argues that at the present levels of income and consumption in the United States, one would expect differences in tastes and in value systems to become more pronounced than they were in the earlier eras of substantial economic scarcity. Differences in tastes and value systems could be expected to have major effects on the demand for children, on the nonmarket aspects of real wages, and on product safety and quality. She points out that differences in preferences would have an important bearing on the evaluation of the informational effectiveness of markets that Maynes discusses within a single set of quality weights or, regarding the paper by Michael and Willis, on the notion that women marrying at later ages may prefer to have children sooner. She believes that explicit treatment of differences in tastes and life-styles may represent an important next step in the analyses of household production and consumption.

VI. CONCLUSIONS

What have we learned? At a general level, I think we have learned from this Conference that substantial progress is being made in the analysis of behavior of the consumer units. In large measure, but not exclusively, this progress is connected with the new theories of household production and characteristics of goods. The papers convey a sense that in many ways consumers behave as if they were producers, and that the economic models can provide useful insights into understanding consumer and household behavior.

We have also gained new knowledge and new insights regarding specific subjects. Thus, to at least some degree, consumers apparently attempt to decide on the number of family members in accordance with the economic theory of household production. Further, the years of schooling may have some effect on the efficiency with which individuals are able to take care of their own and their family's health.

Individuals apparently continue investing in their earning capacity after schooling through choice of jobs with less pay but with large training components, and this investment declines with age. Also, the wage differentials in risky occupations correspond to an actuarial premium of a magnitude which is consistent with other valuations of the financial loss from job-related deaths.

Regarding statistics, we learned that in test cases for two commodity groups, the existing price indexes are not too different from indexes which satisfy the requirements of economic theory permitting substitutions of goods. Also, based on Canadian data, physical quantity indexes of consumption showed much less long-term growth than the deflated expenditures series, even though conceptually the two indexes should provide the same results. The differences in price of different kinds of automobiles can be explained either by physical characteristics, or by consumer-related performance variables, but the two explanations are highly correlated and the second contributes little after allowing for the first. Understanding of the prices of housing and of the demand for it can be much improved by treating houses as highly complex, multi-characteristic goods, rather than single goods.

We have also learned that setting effective safety standards for consumer products imposes very demanding information requirements and that legislative and administrative practices in this regard are highly vulnerable to mistakes and oversights. We also see that some basic conceptual problems exist regarding the design and content of consumer information systems attempting overall evaluations of quality of consumer goods.

Some of the methods used in the Conference papers are complex and impose very demanding data requirements; others are more robust. Of course, the data demands depend on the specific subjects explored, as well as on the methods employed.

How much progress can be anticipated in the research on the consumer sector in the future, particularly in the near future, depends not only on the amount of interest and the number of researchers willing to enter the field, but also on the effectiveness of the techniques employed and on the quality of information available for research.

The techniques, always subject to improvement, appear to be sufficiently developed to permit further explorations along the lines pursued in the papers of this Conference. Lack of data may be a more serious though somewhat ambivalent problem. On the one hand, data appear to pose definite limits to the resolution of some of the complex issues raised in the papers, especially data dealing with the same in-

dividuals over long periods or data dealing with probabilities of events involving consumer products. On the other hand, some of the papers offer examples of fruitful utilization of data which have existed for a long time, e.g., data on the characteristics of houses and automobiles. This suggests that ingenuity in the formulation of research problems so as to utilize available information, as well as collection of own data, may provide opportunities for substantial progress.