THERE IS A NEED FOR APPLIED MICROECONOMETRICS
– Survey Research about the Household

by Anders Klevmarken

> "Year after year economic theorists continue to produce scores of mathematical models and to explore in great detail their formal properties; and the econometricians fit algebraic functions of all possible shapes to essentially the same sets of data without being able to advance, in any perceptible way, a systematic understanding of the structure and the operations of a real economic system."
>
> W. Leontief
>
> (In Science 1982)

1. Introduction

Economics has become a science highly influenced by mathematical and statistical methods. Being an empirical science, good knowledge of mathematical and statistical methods should yield great benefits to the advancement of economics. Mathematics and statistics, however, require an investment in human capital, that is time-consuming to the extent that many economists never get beyond the investment stage. The danger lies in losing contact with economic realities.

It is argued in this paper that understanding *aggregate* "facts" like unemployment, inflation, deficits in the balance of trade and the government budget is not likely to improve very much from the application of new desk theories to the old aggregate data. Too many theoretical constructions will always be consistent with a given set of aggregate "facts". Analyses of *micro* relations, both theoretical and empirical, will pay off much better in terms of accumulated knowledge of economic behavior including better insights about macro-economics.

An increased interest in applied micro-economics already appears to be growing within the economics profession. This is discussed in section 2. In section 3, the particular need for household micro-data is argued and in section 4 problems of collecting and using micro-data are discussed. Section 5 offers a few concluding remarks.

2. A New Interest in Micro-economics

During the 50s and 60s, business cycles and economic growth dominated the interest of the economics profession. Econometric models were first built to explain and forecast the business cycle. The early macro-models designed by

Tinbergen, Klein and others with only a few equations were followed by much larger and more sophisticated models. During the 60s a shift of interest towards problems of economic growth could be observed. Large economic models originating in input-output analysis were built to analyze medium and long-term balance problems. Today these models are used more or less routinely in economic planning and forecasting in many countries.

This development in economic theory and application was parallel to – and was made possible by – a similar development of national accounts, statistical methodology and in computer technology. In many countries, national accounts have been extended and refined to the extent that it is now possible to follow commodity and money flows in much greater detail than immediately after World War II. The compilation of input-output tables has apparently added much useful information to the accounts and at the same time increased consistency and reliability. In spite of this improvement, however, serious measurement errors in the national accounts remain.

The development of econometric methods during the 50s and 60s was completely dominated by the interest in macro-economic applications. The early textbooks in econometrics all concentrate on single equation and system methods for estimating macromodels from time series data of the national accounts type. Since Haavelmo's early contribution to the theory of estimation and testing in stochastically dependent equations, numerous estimation methods have been suggested, most of them based on either least-squares or on maximum likelihood criteria.

The rapid expansion of the capacity of computers made possible the practical application of these statistical methods to larger and larger models. However, even with modern computers we find it difficult to use full information methods for very large models with many parameters. The result is that for these models econometricians have resorted to relatively simple single-equation methods.[1]

In the 70s a new interest for applied micro-economics developed. There were several reasons for this.

First, there has been an increasing interest in the distribution of income and wealth. Since industrial economies have experienced slow economic growth or no growth at all during the 70s, the questions of who should benefit from the small increase in our total resources, and who should give up benefits when our resources decrease, have become much more important than before. Parallel with this interest in distributional problems goes an increased concern with labor market issues, in particular job security, equal rights and female labor supply.

[1] Another reason against using full information methods is that they are not robust against specification errors. The effects on the estimates of a specification error in one part of the model are transmitted to other parts.

Second, econometric macro-models have failed to give reliable forecasts, in particular during the 70s. The economists' view of the possibilities and limitations of macro analyses, based on national accounts type data, has become more realistic. There are several reasons for this. One is a greater awareness of the measurement errors in national accounts. Much work has therefore been devoted to refining the national accounts. Sweden is one example. But the revisions made also reveal the magnitude of the errors built into the accounts. Sometimes these revisions have well exceeded normal annual changes in the series.

Equally important, however, is the low informational content of aggregate macro data. We frequently find it difficult to discriminate between models with very different implications for economic policy. Examples are models for wage and price determination, demand for consumer goods and for investment behavior. Since aggregate data tolerate a wide class of models the choice between them has to be based on other criteria than those implicit in statistical tests. These difficulties arise partly because the aggregation process gives smooth series with common trends and partly because most national accounts series are relatively short. This situation may improve partially as time passes and the data series lengthens. But in practice, new definitions adopted occasionally limit or prohibit the use of long time series. Breaks in the data series do not only reflect improved measurement methods and availability of new information. They also reflect real changes in the economy. Even if one can chain old series numerically to new ones, there are reasons to doubt if this is meaningful. Take, for instance, a series of household expenditures on consumer durables. Would it make sense to look at expenditures during the 30s and the 80s as observations on the same variable? Much of what now goes into the category "consumer durables" did not exist during the 30s and many of these commodities satisfy new needs of the consumers.

With such data problems it is not difficult to understand why econometric macro-models have not proved to be as useful as economists and econometricians originally expected. But there are more fundamental problems with econometric macro-models. The national accounts give, by the definitions of the accounting system, a set of constraints on the macro variables, which in a model framework, usually takes the form of a number of definitional equalities. The important relations in a macro-model are, however, the behavioral and so-called "technical" relations. These are frequently based on an economic theory developed for a single consumer or firm or with assumptions of markets in equilibrium – a theory which is then applied to macro data often without even discussing the aggregation problem. (See also Brownstone's paper in this volume.)

This procedure is analogous to regressing the number of annual lung cancer cases on the total expenditures on tobacco (in fixed prices) to analyze the effect of smoking on cancer. If the epidemiologists and cancer specialists

had been satsified with this kind of analysis we would have known very little today about smoking and cancer.

Although we observe a certain stability in estimated macro relations it is not at all impressive. On the contrary, we frequently find that parameter estimates change in value when new data are added and that forecasts based on macro models only are marginally better than naive forecasts. The difficulty of the models from the 60s to explain the economies of the 70s and 80s is one example. The concept "structural change" is well-known in econometrics.[1] This relational instability indicates a lack of autonomy of the macro relations in the Haavelmo sense (Haavelmo, 1944). Macro aggregates probably hide fundamental changes in the economy, which can only be revealed and analyzed with micro-data.

Data shortage has constrained empirical applications of micro-economics. Although cross-sectional surveys of consumer expenditures and savings, labor force surveys and various surveys of industry and trade have been performed in most countries, they have not been designed for research, and their accessibility for research has been rather limited. However, a slowly increasing supply of micro-data, designed for research purposes, now adds to the growing interest for applied micro-economics. In particular, there are a few American longitudinal data sets which have been repeatedly used in the last decade (The Michigan Panel Study of Income Dynamics, The National Longitudinal Samples, the NBER-Thorndike Sample and Social Security Administration Data). In Sweden the level of living surveys have recently attracted the interest of economists.

Additional reasons for economists' reborn interest in micro studies is the capability of modern computers to handle large data sets and new statistical methods developed for analyses of these data. This will be discussed further below.

3. A Need for Household Data

The increased interest in micro-economics has given an impressive array of results in labor economics. The human capital theory developed by *inter alia* Becker, Mincer and Schultz has produced a wealth of empirical results on earnings, wage distributions and labor supply. Most of these results have been obtained using American data but there is now an increasing number of studies from other countries as well. The development within this field has also gained a higher degree of realism through the so-called search and contract theories. Modeling micro behavior gives an incentive to take

[1] If a parameter estimate changes more than can be attributed to chance when new data are added to the sample, there is an indication of structural change. Since econometric work usually involves a search for a good model specification the standard errors, t-values, etc., usually reported are conditional on the final specification. This implies that these measures might greatly understate the true uncertainty of our estimates.

institutional constraints into account and thus give a greater realism to the analysis.

Much methodological work has also been done in connection with these applications. See, for instance, research on truncated or censored data or on selectivity problems surveyed in Amemiya (1981), Heckman (1976), Manski and McFadden (1982).

Studies of household savings and consumption decisions have a long tradition in economics. Empirical studies of household budget data date at least back to the work of Pierre Le Play (1806-82). In the last few decades research within this area has, however, not been as interesting as in labor economics.

Much effort has been devoted to analyzing aggregate time-series with all the difficulties already mentioned. Micro-data on consumer expenditures have not been used for anything much more sophisticated than classical Engel curve analyses. Recent advances in the theory of family economics might, however, offer new promising research opportunities. This is an approach which incorporates several aspects of household behavior in addition to savings and consumption behavior, namely marriage, household formation, children, schooling, occupational choice, labor supply, household maintenance and leisure activities. Also here, much inspiration comes from the work of Gary Becker, see for instance Becker (1981).

The micro simulation approach belongs to another school of thought which has also argued the need for micro studies. See for instance Orcutt et al. (1976) and Bergmann et al. (1980).

Government statistical agencies produce detailed statistics on industry production, trade and the public sector but much less statistics on the household sector. Compared, for instance, to its share of GNP much more information should be produced about the economic situation of households. One reason for the shortage of such data is the difficulty of obtaining reliable information from households. Contrary to business firms and public authorities households usually do not keep records or make up explicit plans which can be used as an input to data gathering. Depending on what data are asked for they are also more or less reluctant to cooperate. The fear for invasion of privacy causes both difficulties in survey work and constraints to be put on our possibilities to merge and use household data already available in various data files. The number of households and their small size also make data collection expensive, even if it is done on a sampling basis.

Although there are great difficulties involved in collecting household data, new efforts in overcoming them would most certainly pay off. In the end, economic policy aims at increasing the well-being of households. Statistical information about household behavior and well-being is needed to know what policy to follow and how successful it is.

In most countries we find occasional surveys of consumer expenditures, household savings and labor force surveys. With almost no exception these

areas are studied in separate surveys, i.e., a new sample is drawn for each survey. To analyze how the activities and decisions of a household are interrelated we would rather need data on labor supply, earnings and other incomes, savings, consumption and leisure activities for each household. To estimate simple descriptive characteristics of the finite population of households separate surveys are sufficient, but when we want to explain household behavior, and thus need to study relations, more data are needed for each household.

At each point in time we can think of the household as having resources in the form of time, human capital and (financial) wealth. These are used in the labor market, the goods market, the money market and during leisure time, partly to build up new resources and partly for consumption. This is schematically illustrated in Figure 1. Resources in the form of human capital and wealth are initially determined by family background and schooling. These resources are jointly used with time in the labor market to earn income and for investment in market oriented human capital. Labor income, capital income and transfer payments are used for saving activities in the money market and purchase activities in the goods market. Finally, resources are also used during leisure time for maintenance activities, non-market oriented investment activities and pure pleasure and recreational activities.

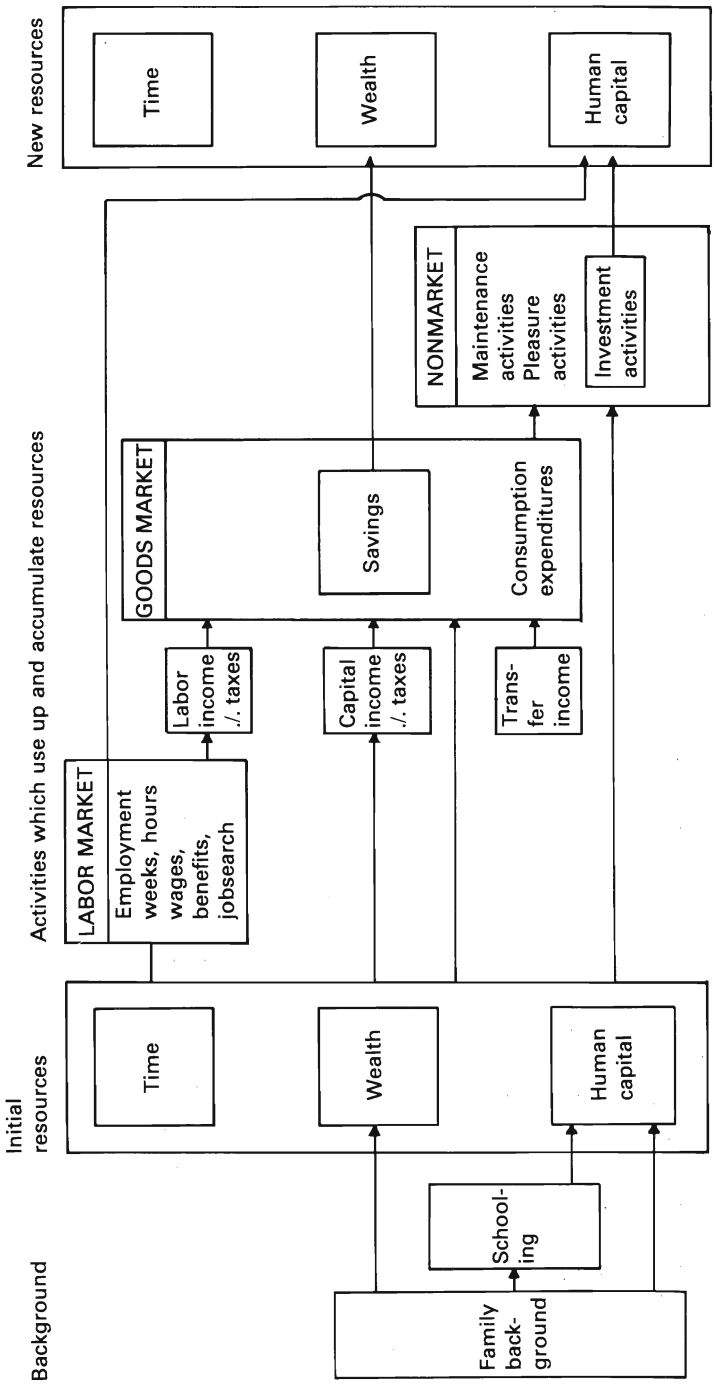
Figure 1 is not a model of household behavior but just a simple illustration of some of the relations between the activities in which a household participates. Depending on the focus of analysis one can rely more or less on the *ceteris paribus* assumption, but, in general, all household decisions are interrelated, particularly in a life cycle perspective. Data which would make possible an analysis of the strength of these interrelations are not yet available anywhere.[1]

The observational unit should be both the household and each household member. The Panel Study of Income Dynamics has shown that the single most important factor in explaining changes in economic well-being is family composition changes like marriage, divorce, death and childbirth, and not as commonly believed, unemployment or changes in pay.

Whether we are interested in the distribution of economic well-being or in explaining household behavior, it is obviously impossible to disregard the household as a "production unit" or the other implications on behavior of the existence of a family. For instance, it could be argued that for the explanation of wealth accumulation and transmission of wealth between generations, an extended family concept is relevant. With individual data only, it will not be possible to see the family influence on economic decisions.

[1] The project Household Market and Nonmarket Activities (HUS), see p. 104 in this volume, was designed to analyze the interrelation of these different aspects of household behavior. According to plans a new household survey would become the first wave of a longitudinal study. The research program can be found in Eliasson and Klevmarken (1981) and an account for the design and the results of a pilot study in Klevmarken (1982).

Figure 1. *Use and accumulation of household resources in market and nonmarket activities*



For studies of the distribution of well-being we can use single cross-sections, but for analyses of the dynamics of household behavior we need repeated observations. With repeated cross-sections we can gain a better understanding of the differences between cross-sectional and longitudinal relationships. It is, for instance, possible to estimate the effects of age, period and cohort, i.e., distinguish between the effects of aging, more or less lasting differences between generations, and temporary effects which influence more or less all birth cohorts (Klevmarken, 1981). Longitudinal data are, however, needed for a truly dynamic analysis. New economic decisions depend on past decisions and experiences, which are best observed directly in a longitudinal design rather than indirectly through retrospective questions. Experiences from the Panel Study of Income Dynamics show that also relatively simple descriptive studies of panel data force us to change our mind about economic behavior (Duncan et al., 1982). The mobility by income and job, and in and out from social benefit programs revealed by panel data is noteworthy.

A few decisions are made only once or a few times during the course of life but have lasting economic consequences for the household. They include education, marriage, childbirth, divorce and even purchase of a house. To explain these decisions and their effects on other decisions and on economic well-being, we would ideally need to observe the household both before and after the decision was made. With longitudinal data it is possible to analyze, for instance, joint decisions about market work and fertility. With longitudinal data on two generations we can analyze the controversial effects of economic, social and cultural background on the economic well-being of the new generation.

Panel data also make it easier to control for unobserved individual differences and thus reduce the effects of certain specification errors. Personal characteristics like "intelligence", "ambition" and "drive" are likely to influence earnings. If these characteristics are unobserved but correlated with other variables which also explain earnings, like schooling and experience, cross-sectional estimates of the effects of the latter variables will be biased. If these personal characteristics are stable over time and there are no interactions between observed and non-observed variables, unbiased estimates of the effects of the observed variables, can be obtained, if the model is estimated in first difference form. This requires, however, at least two observations on each individual.

The great advantage of microdata is *not* the gain in degrees of freedom. The most urgent task is not to reestimate the old macromodels with new microdata to enjoy a higher precision in the estimates. That precision is likely to be misleading. It is much more desirable to take advantage of the rich *variability* in microdata. Individuals are different, households are different, and firms are different. No longer do we have to concentrate exclusively on the average economic man. The dynamics of economic progress might well

be found in the tails of the distributions or in the existence of a dispersion. Used in this way, microdata will move the analyst in a direction towards greater detail and realism. The number of "unknown parameters", however, will increase accordingly.

4. Collecting and Using Microdata

4.1 Response and Privacy Issues

Microdata become available in two ways, either from already existing registers, usually collected for administrative purposes, or through a new survey. Modern computer techniques offer access to register data, but they do not solve all of the problems. Since these data sets were not collected for research they usually do not include all relevant variables and their definitions might not be ideal. The combined use of several registers usually makes analyses easier. If the same individuals can be found in more than one data set, exact matching can be used.[1]

If registers do not include the same individuals but each register is a separate sample, the combined use of these samples becomes more difficult. There are techniques like statistical matching, imputations and predictive methods, but they all have the unavoidable disadvantage that the unobserved correlations are replaced by various assumptions. For this reason, these methods are likely to be most useful in a model based approach, i.e., when inference is not only based on the sampling design but on a subject matter model, for instance an economic model, which provides the theory for these assumptions (see also below).

Protection against invasion of privacy is a problem with both types of data. Legislation puts constraints on how data sets can be merged. There are also constraints on what data can be collected and stored in a computer. The public debate about the privacy issues has developed a consciousness of the general public and even created an unjustified hostility towards surveys and computers.

The nonresponse problems have become severe. To meet these problems, the research community has to demonstrate concern for integrity in its actual use of sensitive data. We also have to spend more time on the dissemination of results to a wider audience, to show that research based on microdata is useful and that there is no threat to personal privacy. In addition, the nonresponse problems can be met along more traditional lines by way of motivation and persuasion. Since research usually has no immediate and direct return to the individual respondent, it might become necessary to use gifts and payments to gain their cooperation. The more frequent survey

[1] The matching procedure is exact in the sense that there is a unique identification concept. Errors also occur in exact matching.

activities become, the likelier it will be that some kind of remuneration to respondents becomes necessary. This will increase the already high costs of survey research, which is something research funds will have to get used to. Also, it will bring about a more careful planning of this kind of research and an even harder priority ranking between research projects.

After a survey is completed, nonresponse problems can also be dealt with by analytical methods. In principle, these methods include an effort to model response behavior and then to use this model to correct for selectivity bias. Before going into this in more detail, it might be useful to take a broader view on the inference problem in survey work.

4.2 Principles of Inference

Traditionally there is a difference in view and emphasis between survey statisticians and econometricians. Survey statisticians are usually interested in an inference to a finite population. They want to find out *what* was. In classical sampling theory there is only one random experiment, namely the sampling procedure. Economists and econometricians are, however, usually not very interested in the finite population of households, firms, etc. but rather in more fundamental economic "laws". They want to know *why* things were the way they were. Population values are treated as realizations of an underlying stochastic model. As a result, the sampling procedure no longer plays a dominant role in the econometricians inference theory. In principle, there are two random experiments which need to be modeled - (1) drawings from the underlying random process (i.e. from the super-population), and (2) sampling from the finite population. It is sometimes justified to neglect the second experiment. This is the type of inference theory we find in most textbooks of regression analysis. In these, there is usually no mention of either sampling design or of a need to weigh the observations inversely proportional to the selection probabilities. Without going into detail, this approach turns out to be correct if the selection probabilities do not depend on any of the endogenous variables of the super-population model, i.e., if the two random experiments are independent. This is not the case for instance when there is self-selectivity. Then the sampling design will also influence inference to the super-population.

There are thus two main differences between the two approaches. One is the difference in interest, the finite vs. the infinite population, and the other the willingness to make assumptions about the universe. The inference theory becomes very different if one is willing to assume that the observations were generated by a linear model as compared to the problem of estimating the least-squares regression line which could be fitted into the entire finite population, whether the observations were generated according to a linear model or not.

In sampling practice one is usually reluctant to bring in untested assumptions about the universe, while in econometrics this has become habitual. In recent years, more emphasis has been placed on a *model-based sampling theory* which brings the two approaches closer together. *A priori* information is brought into design and estimation through a super-population model (Royall, 1970, Smith, 1976, and Cassel, Särndal, Vretman, 1977). The use of models in sampling theory is the subject of debate. It has, for instance, been suggested that one should distinguish between a *model-based* approach and a *model-dependent* approach. In the first case, a combination of design and estimator is chosen which gives consistent estimates *even if the model is unsatisfactory*. *A priori* information is only used to increase efficiency. In a model-dependent approach one might gain even more in efficiency but at the expense of inconsistent estimates if the model would be misspecified. The focus is, however, still on estimating characteristics of the finite population.

Which approach one should prefer is a matter of research strategy and philosophy of science. Is economics such an advanced science that it is justified to assume relatively stable relations or "laws" or do we always have to look upon our results as more or less unique to time and place?

Suppose that we ultimately want to generalize from the finite population to human behavior in a more general (but somewhat unclear) sense. One issue is whether we should do this within the framework of statistical inference or in a different way. Statistical inference then requires an assumption of a super-population model for which one might have more or less justification. If the statistical analysis is limited to the finite population no formal assumptions about a super-population are needed, but any generalization beyond the finite population must rely on some kind of implicit assumptions. An advantage of the super-population approach is that they are made explicit. A possible disadvantge is that the analyst is easily led to make assumptions for mathematical or computational convenience.

A comparison between two statistical methods is frequently based on criteria like consistency bias, variance and mean-square error. In this case the application of these criteria is not straightforward, because the method used to generalize from the finite population has not been specified. There is no common basis for a comparison. One way out might be to compare predictions from the estimated super-population model with the estimated finite relationship.

If it can be assumed that the functional form of the finite relationship is the same as the expected relationship in the super-population model, then the difference between the two approaches stems from the assumptions about the stochastic properties of the super-population model. Given that these assumptions, as well as the assumptions of functional form, are realistic, the super-population approach is likely to make more efficient use of data. But, if they do not hold, systematic errors are, in general, introduced in parameter

estimates and predictions, and the outcome of a comparison based on the mean-square errors is not obvious.

It is sometimes argued that the finite population approach would be more robust against specification errors in the functional form. This is dubious. Suppose that data were generated by a regression model with two explanatory variables but that the relationship fitted only included one of these. Also, assume that the estimates of the included slope parameter are compared. It cannot be difficult to find a true model and a sampling design for which the bias would be larger with the finite population approach than with the model-dependent approach.

In practice, an economic model is usually not estimated in one step only, but the final estimates are arrived at through a search procedure. In econometrics it is common to seek protection against specification errors by pre-testing key assumptions about variables to be included, normality, independece of error terms, etc. In the finite population approach one might also test, if a population regression slope is close to zero, i.e., if the corresponding variable should be excluded. Since the stochastic assumptions behind the two approaches are different, a common test statistic will not necessarily have the same properties and the two approaches can, in principle, result in different specifications of the functional form.

Another consequence of pre-testing is that part of the informational value of the data set is used up for the pre-test, and the efficiency of the estimates of the final model is lower, compared to a situation when no pre-test is needed. In most published work this reduction in efficiency does not show, because it is customary to publish estimates conditional on the assumptions of the final model. Since a super-population model usually involves more assumptions, pre-testing is perhaps more frequent in this approach. The gain in efficiency from a model-dependent approach vs. a finite population approach might thus be smaller than we are led to believe. Also, published results from both approaches tend to overstate the confidence we should have in them. What we perceive as structural changes might well lie within the limits of random variation.

A discussion of the principles of inference from economic survey data invoke basic issues in economic research which economists discuss too seldom. What role is given to economic models and how stable are they in time and space? These principles also have very practical implications for the choice of estimation and test procedures which in turn determine what results we will get. Additional analyses and discussions are needed.

In addition to these general problems of statistical inference, and compared to the traditional analysis of aggregate time-series, microdata offer new statistical problems to the econometrician. For instance, survey variables are frequently discrete, truncated or censored. There are response errors and other non-sampling errors. Indicator- and proxy-variables need particular models and methods. Selectivity is usually a severe problem. The

sampling design might imply a more or less complicated weighting system, etc. Much work has already been done to solve these problems. In particular, there are now a number of models and methods for limited dependent variables and various selectivity phenomena. From a sampling statistician's point of view the treatment of nonresponse is of particular interest. The approach adopted is to model response behavior as well as economic behavior and estimate these partial models simultaneously as one integrated model (Little, 1982, and JASA, Vol. 77, 1982). Nonresponse is just one particular form of self-selection, which is part of human behavior and could be subject to explanations as well as other forms of human behavior. The result is consistent, or sometimes even unbiased, estimates of the economic model.

There are, however, disadvantages. The sampling frame must include the supplementary data needed to model response behavior. The approach is model specific, which means that the sampling weights cannot be adjusted for nonresponse once and for all but each analyst must go through relatively complicated and expensive computations. Finally, the resulting estimates might not be robust against specification errors in the response model.

However, faced with the prospects of low response rates in household surveys, this is an approach we will have to adopt and build into our designs in spite of its drawbacks. Good sampling frames could be obtained from the rapidly increasing number of (administrative) databases. The computer bills are becoming less of a problem with new programs and computers. If methods are developed which build on less rigid assumptions about distributional properties, the sensitivity of these methods to specification errors might also be reduced.

Most of these methods belong to the maximum likelihood family and, more specifically, they usually assume normal distributions. The normality assumption is often difficult to justify except for its convenience. On the contrary, there are sometimes reasons to assume a non-normal distribution. With large data sets it should be possible to leave more to the data and use methods which assume less about functional form. More research is needed to develop such methods.

5. Concluding Remarks

Additional emphasis on microeconomics and applied microeconometrics will not necessarily give an immediate pay-off in improved economic policy. We will face new theoretical and methodological problems which will take time to solve. Human behavior is so variable that it will become difficult to isolate stable micro relations. Micro behavior is probably best interpreted as probability or frequency relations. The need for microeconometrics does *not* imply any need for macro analysis or other approaches. However, the micro

approach makes a close analysis of real decision makers possible. The ways their decisions are constrained by institutional realities can be uncovered rather than be buried by the smoothing filter put on by aggregation. *Rich micro data will leave less room for bad theory*. We could hope to get in a better position for judgements on the stability of macro relations and on the likely direction and speed of structural changes.

Methodological issues have to be addressed, both concerning the principles of inference and more technical problems. More than previously, econometricians will benefit from methods developed within other disciplines like, for instance, survey sampling and multivariate methods for behavioral research. An increased interest in micro behavior will more generally lead to inter-disciplinary work. There are many aspects of human behavior which usually are not treated by economists but contribute to the explanation of economic behavior.

New micro data are essential. This means that the funds needed for economic research will approach those needed in science. There will also be a need for a certain coordination of research efforts since everyone cannot make their own surveys. The increased competition for funds and the necessary coordination of research will repel many researchers within and outside the economics profession. But are there any alternatives?

REFERENCES

Amemiya, T., 1981, Qualitative Choice Models: A Survey, *Journal of Economic Literature,* Vol. XIX (1981), pp. 1483-1536.

Becker, G., 1981, *A Treatise on the Family,* Harvard University Press.

Bergman, B., Eliasson, G., and Orcutt, G., (editors), 1980, *Micro Simulation - Models, Methods and Applications,* IUI Conference Reports 1980:1, Almqvist & Wiksell International, Stockholm.

Cassel, C.-M., Särndal, C. E., and Vretman, J., 1977, *Foundations of Inference in Survey Sampling,* John Woley & Sons.

Duncan, G.J., Juster T.F., and Morgan J.N., 1982, The Role of Panel Studies in a World of Scarce Research Resources; ISR, University of Michigan. Paper prepared for SSRC Conference on Designing Research with Scarce Resources.

Eliasson, G., and Klevmarken, N.A., 1981, *Household Market and Non-market Activities, Research program and proposal.* Research Report No. 12, IUI, Stockholm.

Haavelmo, T., 1944, The Probability Approach in Econometrics, *Supplement to Econometrica,* Vol. 12 (July 1944).

Heckman, J., 1976, The Common Structure of Statistical Models of Truncation, Sample Selection, and Limited Dependent Variables and a Simple Estimator for Such Models, *Annals of Economic and Social Measurement 5,* pp. 475-492.

Klevmarken, N.A., 1981, Age, Period and Cohort Analysis: A Survey, Research Report 1982:1, Department of Statistics, University of Gothenburg.

Klevmarken, N.A., 1982, Household Market and Nonmarket Activities - A Pilot Study, IUI Working Paper No. 77, 1982.

Little, J.A., 1982, Models for Nonresponse in Sample Surveys, *JASA,* Vp., 77 No. 378, pp. 237-250.

Manski, C.F., and Mc Fadden, D., 1982, *Structural Analysis of Descrete Data with Econometric Applications,* MIT Press.

Orcutt. G., Caldwell, S., and Wertheimer II, R., 1976, *Policy Exploration through Microanalytic Simulation,* The Urban Institute, Washington.

Royall, R.M., 1970, On Finite Population Sampling Theory under Certain Linear Regression Models, *Biometrika,* 57, pp. 377-387.

Smith, T.M.F., 1976, The Foundations of Survey Sampling: A Review, *Journal of the Royal Statistical Society,* Ser. A, Vol. 139, pp. 183-204.