An Econometric Analysis of Household Consumption Patterns: A Comparative Study Based on New Zealand and Italian Household Budget Data

A thesis presented in partial fulfilment
of the requirements for the degree
of PhD
in Economics at

MASSEY UNIVERSITY

Claudio Michelini

1997

Abstract

Econometric analysis of household expenditure is a very important area of economic inquiry because the estimated demand parameters are particularly useful in many behavioural aspects of demand forecasting and in welfare issues. This paper analyses and compares expenditure patterns in New Zealand and Italy by estimating preference-consistent complete demand systems directly derived from utility or cost functions of increasing complexity.

Because demographic factors have been recognised as essential components of empirical models of household consumption since the early studies by Engel, we use information on the number of children in the household to test for demographic effects on demand, and check whether similar economic conclusions and model acceptance decisions are supported by the two different sets of data we use, which, for both countries, are derived from household consumption surveys pooled across several time periods.

We approach the problem of how to introduce demographic variables into the demand models' analytical framework in a variety of ways, from the simple addition of a few demographic variables to the long established Linear Expenditure System (LES), on to the theoretically more advanced technique of introducing the demographic variables directly into the demand system via the utility function, as we do in the case of the Demographic Cost Scaling model introduced in Chapter 4.

The estimated models have been compared and tested to identify the ones that are more likely to describe and interpret the data correctly. The ones that are selected are then used to compute the price, income and demographic variable elasticities, both for the whole sample of households considered in the surveys as well as for households of specific size.

The computed elasticities have been analysed and checked for consistency with the tenets of the theory of consumer behaviour, and whenever found to be in contradiction to them, efforts are made to find out whether this was due to social or economic reasons, specific to the economies of the countries under study, or, more simply, to model or data inadequacies.

Because most of the demand models considered in this study are highly non-linear, and their parameters have to be estimated by iterative methods, we took great care to check the iterative performance of the estimation algorithms we used by making sure that, when estimating a model's parameters from the data at hand, the iterative procedure always converged to the same set of parameter estimates from all, or most, of the sets of parameter values we had selected to start the estimation procedure with. Most of all we checked carefully that the models' iterative estimation procedures did not show *sensitive dependence on initial conditions* - generating a different set of parameter estimates for every set of starting values, even similar ones (these types of systems, impossible to control or predict, are also called *chaotic*).

Although many of the demand models we have analysed showed chaotic behaviour during estimation, which reflected their inadequacy to explain the empirical data, the parameter estimates resulting from the estimation procedure itself often appeared to have good statistical properties. Therefore, it became apparent that the behaviour of a model estimation procedure should be considered very carefully when choosing, among different non-linear models, the most appropriate ones to describe and explain a set of data, because such models are likely to reveal any existing model inadequacies better than the customary statistical tests performed *after* the model has been estimated. In fact, we found that a well behaved iterative estimation process almost always provides parameter estimates which satisfy statistical criteria, and fulfil the model economic expectations.

Another empirical problem we had to resolve was to try and find some guidelines on how far, in household consumption studies, commodities should and could be aggregated into broader categories. This of course is a very important issue as demographically augmented models, because of their complexity, are often estimated with respect to only a few highly aggregated commodity groups, under the implicit assumption of "separability". We checked whether or not such a high level of aggregation allows meaningful empirical analysis of consumer behaviour, and found that, at least in the case of Italy, increasing the number of consumption categories from four to six did not increase the explanatory power of the models.

There are two more interesting theoretical results we have obtained in this study: one is the rejection by all models, and for both countries, of the hypothesis of income-

linearity of the Engel curves; and the second is the empirical rejection, again by all models and for both countries, of the negative semi-definitiveness of the Slutsky matrix. This, latter, is a theoretical requirement which is seldom fulfilled in practice.

The introduction of demographic variables into the demand models made it necessary to convert households of different size and composition to equivalent units, before their consumption patterns could be properly compared. To this end we computed, for both New Zealand and Italy, constant-utility household consumption equivalence scales, to convert the expenditures of households of different compositions and sizes to standardised consumption units, based on the consumption of a "reference household". To estimate such equivalence scales, we used both an expanded version of the Linear Expenditure System, discussed and estimated in Chapter 2, and, with less success, the DT-RNLPS model, explained and estimated in Chapter 4. The resulting commodity-specific equivalence scales are, to our knowledge, the first of their kind estimated with New Zealand household expenditure data.

The main problem encountered persistently in our work has been the inadequacy of the data which, for both countries, only reported cell averages, instead of individual household observations and, in the case of Italy give no information on household composition, only the number of members in a household. This drawback in regard to the adequacy and appropriateness of the available data makes our results in some areas open to question. But, one of the useful contributions our study makes lies in its drawing attention to the nature of the statistical information base provided by household budgets, both in Italy and New Zealand. Improvements in data collection and presentation can only take place if researchers communicate their difficulties to the statistical agencies responsible. Studies such as the present one are therefore an invaluable part of the interface between data gathering, presentation, and use.

Acknowledgements

It is, first of all, my pleasure to thank my supervisor, and old friend, Professor Srikanta Chatterjee. His thoughtful advice, creative criticism and, most of all, the many discussions on all aspects of this research have been invaluable to the progress and the final shape of this work. Without him, I doubt very much that I would have started working on my thesis, and I am almost certain that I might not have finished it.

My thanks are also due to my second supervisor Professor Rolf D Cremer for his encouragement and support, and to Mr A Swift of the Mathematics Department of Massey University for his help in translating all my computer programs and data from Macintosh into Windows, at a crucial stage of my work, and for discussing with me the partial differentiation procedure we used to compute the elasticities reported in this study.

I also wish to thank the Department of Statistics of Florence University for supplying me with the Italian data, free of charge, and in a format ready for use in the type of computer and the econometric package I was using at the time. Without their help, one half of my work would have been impossible.

Special thanks are also due to Professors R Leoni and G Calzolari of the Department of Statistics of Florence University, and to Professor M Faliva, Chairman of the Department of Econometrics of the Universita' Cattolica in Milan, for discussing with me parts of my thesis, when I visited their departments during autumn 1996, to present a Seminar based on Chapters 4 and 5 of my thesis. Their comments have been invaluable and have improved the quality of my empirical work reported in these two chapters.

I must also acknowledge the help of Ms G de Joux, of the Department of Mathematics of Massey University, for transforming my messy tables and formulas into neat rows of numbers and symbols.

Finally, as tradition requires, I must thank my wife Bruna for her support and patience while I was beavering away at my research and deserting her for a Macintosh PC. However, she is likely to say that this has been my normal behaviour during most of our married life.

Contents

List of Tables and Figures