Chapter 1

INTRODUCTION

1.1 Introduction

The studies on Complete Demand Systems (CDS) are of recent origin, although applied work in consumer demand has a long history. The initial empirical work on consumer demand has confined to Engel curve analysis and quantification of partial demand relations. Allen and Powley (1935), Wold and Jureen (1953), Pras and Houthakker (1955), have systematised Engel curve analysis and Schultz (1933), Wold and Jureen (1953) and Stone (1954) have pioneered the studies on partial demand relations incorporating the influence of prices, though partially, into the demand functions. The above studies are restrictive: Engel curve analysis ignores the influence of prices while partial demand relations are often inconsistent with general equilibrium models. Wald (1940), Frisch (1959) and Stone (1954) have initiated investigations in bridging the gap between well structured preference theory and applied demand analysis. The developments in simultaneous equation methods of estimation and the advent of computers for solving large scale systems have also stimulated a large number of studies on CDS.

There are two broad approaches for the analysis of CDS. The first approach deals with the estimation of indifference surfaces. Wald (1940) has developed a sophisticated method
to estimate Quadratic Utility Function (QUF) from time series of cross-section data on family budgets. However, this method has not provoked much applied work as its computations are very intricate and its data requirements are very stringent. Further, the recent advancements in econometric techniques could not be employed easily.

In the second approach, demand for each commodity is specified as a function of prices of all commodities and income (total expenditure, in fact) and the theoretical postulates are either built into the model or imposed as restrictions on parameters in the estimation procedure. In demand models such as Linear Expenditure System (LES), Direct and Indirect Addilog Systems (DAS and IAS) and Direct and Indirect Translog Systems (DTS and ITS), the theoretical properties are built into the models as they are derived from a well-behaved utility function.\(^1\) In models such as Rotterdam Demand System (RDS), Frisch Complete Demand Scheme (FCS) and Pearce Demand System (PDS) etc., the theoretical properties are imposed in the estimation procedure.\(^2\) Some of the above models can as well be broadly classified as additive and non-additive type. The additive

\(^1\) However, the fulfilment of second order (convexity) conditions is not guaranteed for these models.

\(^2\) The imposition of Slutsky Symmetry guarantees the existence of utility function.
models are rather restrictive, do not allow inferior goods and imposes severe restrictions on price effects. On the other hand more flexible forms are very data demanding and likely to create econometric problems, particularly when there is not enough statistical variation in data.

The LES, IAS, BDS and FDS are generally the focal points of empirical investigations. LES has been an intensive area of investigation ever since the pioneering work of Stone (1954). Most of the empirical studies apply demonstrate the fruitfulness of LES for analysing the demand structure of broad groups of commodities. Some attempts have also been made to extend the LES by introducing time trends, habit formation etc. Pollack and Vales (1969), Pollack (1970) The hierarchic model has considerably simplified the numerical problems. Deaton (1974).

The IAS has been first introduced by Houthakker (1960) along with its dual DAS. On theoretical grounds the IAS has many attractive properties: It has nonlinear Engel curves and also permits inferior as well as complementary goods. However, the model severely restricts the cross price effects. The few attempts that have been made to

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3/ For a comprehensive survey of the works on CDS, see Brown and Deaton (1972).

4/ The details about properties of various are discussed in chapter 3.
estimate this model, have also compared its performance with that of LBS. Somermeyer and others (1962), Parks (1969), Yoshihara (1969), Thael (1971), Solari (1971), and Paschet and Debrue (1971). Not all these studies have led to the same conclusions; the results of Parks, Yoshihara and Thael suggest that the LBS does much better of the two, while Solari, Paschet and Debrue show marginal difference between them.

The RES has also been applied for testing the validity of theoretical postulates for some countries viz. Holland, Spain, United Kingdom and Sweden. Barton (1967, 1969), Luch (1971), Beaton, (1974), Parks (1969). The empirical results show considerable uniformity among the studies. Most of the above studies indicate the rejection of homogeneity. This is surprising since more restrictive hypothesis like symmetry has passed the test while homogeneity could not. This anomaly is sometimes attributed to the fact that RES cannot incorporate integrability conditions.

However the system may be considered a reasonable approximation to reality in narrow ranges of income Barton (1969).

A majority of studies on CBS deal with the estimation rather than testing the theoretical postulates. They also

5/ McFadden (1964b) and Yoshihara (1969) have shown that the imposition of integrability will reduce the Rotterdam model to the simplest of all models viz., Bergson type.
mostly use mean level time series data. No attempt has been made to estimate CBS from time series of cross section data. The estimation of CBS from time series of cross section data has the advantage of large variation in total expenditure and it involves less aggregation over consumers. Further it gives a large number of degrees of freedom for analysing structural features. It is also worth mentioning that very few comprehensive studies on CBS have been reported for developing countries.

1.2 Objectives of this study

This study seeks to estimate CBS for India from time series of cross section data with a view to bring out the structural features relating to income distribution and regional dualism (rural, urban) etc. To be specific, the study focuses on the following aspects: (i) goodness of fit of selected models, (ii) adequacy of a single model to approximate the non-linearities in the observed expenditure data, (iii) interclass and inter-sectoral variation in consumption patterns, (iv) patterns in expenditure and price elasticities across expenditure groups and rural-urban dichotomy and (v) extent to which the available data uphold the postulates of micro-economic theory of consumer behaviour.

1.3 Previous Studies on Indian Consumption Patterns

The availability of National Sample Survey (NSS) data on consumer expenditure has led to a large number of studies.
on consumption patterns. However, a majority of these studies are confined to Engel curve analysis. The choice of functional form and the stability of Engel curves over time have received wider attention. The empirical evidence relating to the choice of functional form among two parameter Engel curves is generally inconclusive. Some studies tend to favour the Log-Log Inverse three parameter) Engel curve viz. Bhattacharya and Maitra (1969). The studies on the stability of Engel curves also tend to show the variations of Engel curves over time. This is perhaps due to the changes in price structure.

The specification of Engel curves has also been improved by incorporating variables relating to family composition, household size and occupation effects. A notable contribution has been made to estimate expenditure elasticities from concentration curves Iyengar (1960). Some of the important works are: Ganguly (1960), Iyengar (1964), Gupta (1968), Balvir Singh (1968), Radhakrishna (1969), Mahajan (1972), Coondo (1975), and Jain (1975). For a critical review of these studies, see Bhattacharya (1975).

For an review of these studies on Engel curves see Bhattacharya (1964), Coondo (1975) and Jain (1975).

The alternative functional forms have been compared by using coefficient of determination (R^2) and Mahalanobis-R^2. Mention may be made of an attempt by Bhattacharya and Maitra (1969), to examine the suitability of the functional by considering the residuals around the Engel curves.
Engel curves have also been integrated with income distribution by Iyengar (1960b), Iyengar and Jain (1973) and Jain (1975).

The expenditure elasticities obtained from Engel curve analysis have been extensively employed for demand projections. The demand projections based on income elasticities generally imply the following assumptions: the insensitivity of consumer behaviour to changes in prices, invariance of income elasticities with respect to changes in income and price structure. Demand projections made at mean level further ignores the changes in income distribution. These assumptions are very restrictive.

The influence of prices both on household consumption and income elasticities have been revealed by some studies on CBS for India. It would also be unrealistic to assume away the shifts in income distribution. It is well known that the fluctuations in agricultural output alter the income terms of trade.

The studies on CBS for India are of two types: some have estimated indifference surfaces and while others have estimated demand functions. Radhakrishna (1969),

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2/ See the studies of Paul and Rudra (1964), Bhattacharya (1967), Joseph (1968), Radhakrishna and Murty (1973), Radhakrishna and Murty (1977) and Radhakrishna (1978).
Mahajan (1972), Radhakrishna and Murty (1975), have estimated QF from family budget data. The empirical results have revealed the violation of convexity conditions. The parameter estimates are also highly susceptible to measurement errors.

The LES has been an intensive area of investigation. Some have fitted LES to time series data on mean level per capita expenditure (Paul and Rudra (1964), Bhattacharya (1967), Joseph (1968), Radhakrishna and Murty (1973), Murty (1977)) whilst others have fitted it to time series of cross section data (Radhakrishna and Murty (1973)). The results broadly indicate the suitability of LES for time series data. Some attempts have also been made to overcome the linearity restriction implied by the LES by postulating piecewise LES (Radhakrishna and Murty (1973)). The LES has been fitted to three expenditure groups separately for rural and urban areas. The results have shown the suitability of LES for local approximations and revealed sizeable variations in the parameters across the income groups.

Very few studies have been reported on the other CES: FCS has been employed to compute the complete set of elasticities for a region (Radhakrishna and Murty (1973)). Iyengar and Rao (1968) have fitted IAS to a single cross section data. Radhakrishna and Murty (1977) have made some attempts to estimate IAS using time series of cross-section data. The results have shown the violation of convexity.
1.4 Models, data and estimation

We have confined our study to the analysis of: IAS from Additive Class, ITS and RDS from Non-additive Class. The data used in our empirical analysis include time series as well as time series of cross section data on per capita monthly consumer expenditure published in the NSS reports for the rounds (2-20) for Rural India and (3-20) for Urban India. The analysis has been carried out at three levels of commodity classification and five levels of income grouping. The price data has been constructed from Economic Advisor's wholesale price indices for detailed items with 1952-53 as base (with base year prices as unitics) and using 13th NSS round expenditure shares as weights. A non-linear method for IAS and ITS, and maximum likelihood method of estimation for RDS have been employed.

1.5 Plan of the study

Chapters 2 through 4 give the theoretical part and 5 through 9 give the empirical part of the study.

Chapter 2 gives the theory of consumer behaviour that is relevant to our analysis. It presents the structure of preference theory, the hypotheses derived from utility maximisation etc. The problems of aggregation across individuals and commodities have been highlighted. The implications of separability on the income and price effects
Chapter 3 deals with the formulation and analytical properties of CBS. The models considered are LES, IAS, EAS, RDS, PCS, DTS, ITS, and others. The underlying implications of the above models in terms of the behaviour of elasticities with income, and the interrelationships among the complete set of elasticities have been discussed. Chapter 4 deals with the problems of inference in CBS. These include estimation of CBS as well as tests of hypotheses. The various measures for choosing among alternative functional forms have also been indicated. The estimation procedures considered are maximum likelihood and non-linear least squares. The problem of singularity of error covariance matrix and its remedial measures while estimating the CBS are also highlighted. The usual asymptotic tests for testing the validity of theoretical hypotheses are also discussed. The numerical procedures employed in the estimation of CBS are also indicated.

Chapter 5 gives the details of the data base. Since, National Sample Survey (NSS) is the main source, an extensive account of the NSS, covering sample size, duration of the rounds, reference period, etc. has also been given. The gaps in the data base have also been pointed out.

Chapter 6 deals with the empirical results on IAS. The results have been presented separately for time series
model, time series of cross section model and piecewise models. The results are given under two error specifications. The inter-sample and post-sample predictive power as shown by quasi-$R^2$, and average information inaccuracy has been examined. The price and expenditure elasticities have been given at various expenditure levels.

Chapter 7 presents the empirical results of its separately for rural-urban areas and income groups. It also presents the results of the tests carried out for the validity of theoretical hypotheses and additivity. The affect of alternative specifications on goodness of fit has been brought out. The expenditure and price elasticities are given for different income groups and their underlying patterns are depicted.

We present in chapter 6, results of our extensive experiments with the RDS. The parameter estimates of RDS have been presented at four and six commodity level, separately for three income groups, with a further rural-urban break-up. We also give the parameter estimates obtained after imposing homogeneity, symmetry and additivity. The results of the asymptotic tests of theoretical hypotheses are analysed. The implications of these restrictions on explanatory power is also examined. The behaviour of expenditure elasticities across income groups and the cross price effects of foodgrains are analysed.
Chapter 9, summarises the empirical results of the three models, and points out the similarities and dissimilarities in them. The influence of various theoretical constraints on the explanatory power of the models have been brought out. An attempt has also been made to bring out the structural features of the Indian economy by using the results of RDS. The effects of income redistribution and the foodgrains price change on different sectors have been indicated. A brief mention of the limitation is also made.