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Analysis of Household Expenditures

Angus Deaton and Anne Case

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ANALYSIS OF HOUSEHOLD EXPENDITURES

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PREFACE

The Living Standards Measurement Study (LSMS) was established by the World Bank in 1980 to explore ways of improving the type and quality of household data collected by Third World statistical offices. Its goal is to foster increased use of household data as a basis for policy decision making. Specifically, the LSMS is working to develop new methods to monitor progress in raising levels of living, to identify the consequences for households of past and proposed government policies, and to improve communications between survey statisticians, analysts, and policy makers.

The LSMS Working Paper series was started to disseminate intermediate products from the LSMS. Publications in the series include critical surveys covering different aspects of the LSMS data collection program; reports on improved methodologies for using Living Standards Survey (LSS) data; and recommendations on specific survey, questionnaire and data processing designs. Future publications will demonstrate the breadth of policy analysis that can be carried out using LSS data.

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ABSTRACT

In any society, one of the ultimate objectives of the economic system is to deliver goods and services to its members. The success of an economy can be measured by its ability to provide for its people, to feed them, to clothe and shelter them, and to offer them access to good health, to education and to a wide range of consumer goods. The household expenditure survey is the tool through which material welfare is measured. Its results inform about levels of living, about how these levels change over time, and about how levels of living vary among individuals and groups in the economy. Beyond this point, the wealth of data from such surveys provides an information base that, in the short run, is an essential prerequisite for the evaluation of actual or proposed policies and, in the long run, by enhancing our understanding of how the economy functions, allows the evolution of better policies for progress and development.

Using household expenditure surveys, we can explore a wide range of issues that are both of substantive interest in their own right, and that help improve our understanding of the functioning of the economy. In this paper, we devote space to three such analytical issues; the estimation of Engel curves, that is, the relationship between demand patterns, household budgets, and their demographic composition; the calculation of measures of the costs of maintaining children; and the calculation of price indices.

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CHAPTER I

WHY MEASURE AND STUDY HOUSEHOLD EXPENDITURES?

In any society, one of the ultimate objectives of the economic system is to deliver goods and services to its members. The success of an economy can be measured by its ability to provide for its people, to feed them, to clothe and shelter them, and to offer them access to good health, to education and to a wide range of consumer goods. On such things depends the material welfare of individuals, so that to measure material welfare, we must measure what and how much individuals consume. The household expenditure survey is the tool through which such measurement is done. Its results inform about levels of living, about how these levels change over time, and about how levels of living vary among individuals and groups in the economy. Beyond this, the wealth of data from such surveys provides an information base that, in the short run, is an essential prerequisite for the evaluation of actual or proposed policies and, in the longer run, by enhancing our understanding of how the economy functions, allows the evolution of better policies for progress and development.

In this introductory chapter, we expand on these themes in preparation for the more detailed illustrations in the later chapters.

Household Surveys and Living Standards

The LSMS household budget survey is a component of the overall LSS household survey that is described in detail elsewhere. The household

expenditures section of the survey is designed to provide a representative picture over a country as a whole of living standards and of the consumption levels of various goods. The randomness of the survey design is of crucial importance in guaranteeing that the households included are representative. It also ensures that quite small samples relative to the total population (usually about 1 in 5000) are sufficient to give an accurate guide as to what is happening in the country as a whole. In gathering the information, the survey is not designed to estimate a single quantity, but rather to provide data on a whole range of important indicators of living standards. Prime amongst these is a measure of total household consumption or command over resources. Within the LSMS framework, this is the central indicator of material welfare, though as will be emphasized later, it must be interpreted in conjunction with other data. Total consumption consists not only of goods and services purchased by households, but also those that they produce and consume themselves, as well as those important items (such as education and health facilities) that are frequently provided at least in part on a communal basis. The elements of household consumption are also of interest in their own right. Patterns of consumption within the budget are important determinants of the structure of economic activity, while the amounts consumed of various goods, particularly foodstuffs, are among the determinants of nutritional status, of health and of life-expectancy.

Two other elements of the survey should also be noted. Because it covers the country as a whole, it provides data on the variation of consumption patterns and expenditures across regions and over groups of individuals. Efficient survey design in most developing countries requires that the sample is broken up into separate regional or urban versus rural

surveys, each with its own sampling proportions, so that a natural output of the survey is a corresponding regional breakdown of results. Even when not built into the design, samples are usually large enough and representative enough to allow breakdowns by other groups, for example, by occupational or employment status. The value of such results is further enhanced if the second element is incorporated, that is if the survey is repeated, if not annually, at least at fairly regular intervals. Comparison of results between surveys then permits an assessment of the evolution of living standards over time, both in aggregate, and for specific groups of interest. Two household surveys on a consistent basis but at different dates have an informational value much greater than twice that of a single survey.

Once the data from the survey have been collected and processed, the first results typically take the form of a published report containing tables of the main variables of interest. These provide a compact description in a fairly standard form of household living standards and consumption patterns at the time of survey. We give examples of such descriptions in Chapter II. The principal tables consist of estimates of total household expenditure and of its components, often in some detail. Means for the population as a whole are estimated, as are means for various subgroups distinguished (among other things) by region, by occupation, by income and by family composition. Such figures paint the broad outlines of who gets what and fulfill what has traditionally been the most important role of household budget data, to highlight the living conditions of the poor and to contrast them with those of the rich, or at least with those of the moderately well-off administrators and politicians at whom the survey results are aimed. Indeed, the earliest household surveys in 18th and 19th century Europe were conceived with exactly

this purpose in mind, to document the poverty in which most households lived, to overcome ignorance of this poverty by those in power, and to agitate for social reform. For many countries even today, household surveys retain an important role in providing information on distribution and poverty that otherwise would be either unavailable or too easily and conveniently ignored. Of course, even at a descriptive level, the data have many other uses. The consumption totals are an important supplementary source and cross-check for the national accounts. The pattern of demand, as represented by the shares of each expenditure in the total, can be compared both across countries and across time and, since we know a great deal about how these patterns change historically and with economic development, any given set of shares provides useful indicators of development. Expenditure shares also have the advantage of being dimensionless and thus are free of at least some of the measurement problems inherent in comparisons of, for example, per capita GDP in U.S. dollars.

Surveys as a Data Base for Policy Analysis

However valuable the survey report with its tables and cross-tabulations, it by no means exhausts the usefulness of the expenditure survey as a data base. Indeed, if the survey report is the only use ever made of the survey material, then the survey has only yielded a very small fraction of the total possible return to the resources used to set it up. Unfortunately, this sort of waste of resources is very common in practice, and one of the major aims of the LSMS is to encourage the full and efficient use of survey results primarily in policy making and secondarily in research. In a typical household survey, some ten thousand households are interviewed, and each may

provide quantitative or qualitative responses to several hundred questions. The original data set therefore contains between one and ten million separate numbers. Of course much of this information, even if accurate, is essentially irrelevant; the largely random variations in behaviour from one individual to the next are of little or no interest either for description or the conduct of policy. But these millions of numbers can be thought of as delineating the empirical joint distribution of hundreds of variables, only a tiny fraction of which is represented in the one-way, two-way or three-way cross-tabulations that can appear in any report, however well-designed. In consequence, the informational requirements of day-to-day policy evaluation and discussion, even if met by the survey, may well not be met by the published report except in the unlikely event of the report just happening to contain the precise tabulation required.

We shall discuss examples of policy needs in several of the later chapters and summarize some of the most important below, but it is clear that the full exploitation of survey results requires that the full data set must be maintained in a readily accessible form even after the first reports have been published. New cross-tabulations should be obtainable very fast and at low cost. These are not heavy demands in terms of modern computing and yet the conditions for fulfilling them do not exist in a large number of countries. Hopefully, the rapidly falling real cost of computing throughout the world will soon remove such bottlenecks. But it is only when they are removed that household surveys will yield the returns of which they are capable.

What, then, are the policies for which household expenditure data are so useful? The most obvious is the direction of aid, both inter- and intra-

nationally, where cash transfers are influenced by measures of poverty, most usually by fairly crude figures such as the fraction of the population below the poverty line. Household budget surveys are the source both for the poverty line itself and for the counts of individuals below it. But even without any formal link between aid and poverty, virtually all policy-making in poor countries is carried out with the consequences for the poor born heavily in mind, so that knowledge of who are the poor, where they are located, and what they do to earn such support as they have, are indispensable ingredients in any intelligent policy discussion. It is also generally understood that the definition of poverty is a matter of great difficulty: should it be based on food? On total expenditure? On nutritional or health status? And if either of the former, how should we account for the differing needs of children and (perhaps) of women? We shall address some of these issues in Chapter IV below, but the very presence of this uncertainty underlines the necessity of being able to take alternative approaches. Policy makers must be able to make alternative definitions of poverty and to explore the consequences of them for the incidence of "poverty" and the consequent targeting of policy. Once again, this can only be done if the basic data are readily available for the alternative calculations to be carried out quickly.

Household expenditure information is also indispensable in a second major policy area, that of pricing, taxation and subsidy policy. In many developing countries, it is difficult to collect income taxes except from a rather small fraction of the population (those who work for the government or elsewhere in the formal sector), so that indirect taxation (including pricing policy and taxes on imports and exports) becomes the main instrument for raising revenue and for meeting distributional objectives. Subsidies of

various forms are also typically important especially for food where governments see the various schemes that exist as a means of guaranteeing access to basic foods for the poor. Without household expenditure surveys, it is impossible to assess even the immediate effects of such policies. However, even minimal expenditure data can take us a long way. If we know how much is consumed in aggregate together with some idea of response elasticity, we have a first round estimate of the revenue that will be raised or lost by a tax change. Just as important, if we know who consumes what, we can tell whose welfare is affected by the tax change and, within an approximation, by how much. For example, if the demand for a good tends to rise with income, or to be confined to certain regions, then increasing the tax on it will be progressive or will discriminate against those regions as the case may be. Similarly, for food subsidy and distribution schemes, household expenditure data tell us where the needs are located and thus how such schemes can be designed so as to best serve those they are intended to help. To date, household survey data have been less used in this respect than in the measurement of poverty. However, it is also clear that many developing (and many developed) countries have tax and subsidy systems that are the more or less random result of the accretion of many different schemes each introduced on a piecemeal basis. Systematic reconsideration of existing structures in the light of their distributional and revenue consequences is an exercise that is likely to have very large beneficial consequences at potentially very low cost and it is an exercise that is impossible without good household budget data. These issues are discussed at somewhat greater length in Chapter V below.

There are many other good examples of the link between survey data and policy but we mention here only one more. This is the part played by household expenditure data in planning. Few developing countries leave the structure of industry, employment and output entirely to determination by market forces, although the degree of central direction varies enormously from country to country. But whether the government is merely monitoring development or actively planning it, a central question is how the structure of the economy will or should develop over time. Planners must know which industries and areas of employment will expand relatively and which will contract. They must plan agricultural output and investment and set pricing policies and procurement schemes so that, at least on average, the demand for food can be met. Imports and exports of specific goods must be allowed for and, in many countries this means setting quotas and planning foreign exchange availability. In all of this, a central element is the structure of final demand, its location, how it develops with changes in income and with the distribution of that income between individuals and socioeconomic groups. Again, household budget data can provide much relevant information. The development of demand patterns across households as income varies can give guidance (although not, unfortunately, solid predictions) as to what will happen as income varies in the future. Similarly, information on the demand patterns of particular groups enables an assessment of future changes in demand as the relative importance and earning power of such groups changes over time.

Surveys as a Data Base for Research

All the uses of the data discussed so far require little more than cross-tabulation and inspection. If we go beyond this to a more analytical treatment, it is possible to explore a wide range of issues that are both of substantive interest in their own right, and that help improve our understanding of the functioning of the economy. In this working paper, we devote space to three such analytical issues; the estimation of Engel curves, that is, the relationships between demand patterns, household budgets, and their demographic composition; the calculation of measures of the costs of maintaining children; and the calculation of price indices. The remainder of this introduction contains a brief discussion of each of these topics and explains why we believe that they are important enough to single out for illustration in this study. Note however that, by focussing on these areas, we do not seek to underplay the importance of other topics for analysis. In practice, different questions will have different urgencies in different countries. However, we expect that the three topics dealt with here will be of general interest.

Engel curves are a systematic way of summarizing and describing the development of consumption patterns as material resources increase. Hence, the derivation and estimation of Engel curves is the obvious next step in the analysis after the cross-tabulations have been drawn up. An explicit mathematical relationship between demands and household resources allows us to be more precise about the policy analyses discussed in the foregoing paragraphs. Consider again the welfare effects of a price increase. It can be shown that, to a first approximation, the elasticity of a given household's cost-of-living with respect to the price change is given by the share in the

household's budget taken up by that commodity. Hence, if we view each Engel curve as defining the relationship between the budget share and total household expenditure (and this is the view that we shall formalize below), then the Engel curve for a good delineates the distributional effects of a change in its price.

Planning is another case where estimated Engel curves are useful. Explicit mathematical forms are required for insertion into formal planning models and provide the vital link between generated income and the pattern of demand and thence to the structure of industrial and agricultural output and finally back to employment and incomes. Such applications effectively assume that Engel curves estimated from household surveys can be validly used to project demands over time. Given the lack of alternative sources for demand equations, such an assumption is probably inevitable. Nevertheless, it must be treated with caution. By its nature, a cross-section as revealed by a household survey compares different households at different income levels and one cannot be certain of the differences in behavior of the same households at different income levels. For example, behavior may be conditioned by relative as well as by absolute incomes, so that proportional changes in all incomes, as might occur with general economic growth, might well leave average demand patterns approximately constant, even though in any given cross-section, demand patterns are quite different at different income levels. Similar phenomena also operate across countries as the tastes and technology that accompany economic growth in the more developed countries are only partially transmitted to their less developed neighbors. At the level of the raw data, there are clear and major inconsistencies between cross-sectional, time-series, and cross-country Engel curves. At a technical level, the problem is

one of inadequate conditioning; income in a time series has apparently different effects from income in a cross-section because different things are being (implicitly) held constant in the two experiments. If we could document these other effects, and take them into account, the two measures of the income effects would come together and it would be safe to predict using Engel curves. In practice, prediction is easier and safer the more household surveys that are available since, with suitable corrections, it is possible to use each survey to check out the predictions made with the aid of its predecessor.

Much of the literature on Engel curve analysis in developing countries, and there is a great deal of it, has been concerned with a search for the "best" function representing the curves. The scope and method of this work is typically limited by the unavailability of the individual household data, so that researchers must work with means of arbitrarily defined cells thus losing important information that was available in the original survey. With the individual data, the straightjacket is removed and it is possible to work with models that are simultaneously both simpler and more powerful. In Chapter III below we illustrate how this can be done.

Engel curve analysis is the starting point for our other illustrative topics. The presence of children in the household clearly affects its demand pattern and so must be taken into account if demands are to be understood and predicted. At the same time, the alterations that children bring to household consumption have traditionally been the basis for attempts to estimate the costs of their upkeep. Taking the positive question first, demographic variables or "household composition", as represented by the numbers of people in the household, their age and sex, are the principal explanatory variables,

along with income, in explaining demand patterns in cross-section analysis. Although income (or total outlay) is usually the dominant variable in the explanation, it is clearly necessary that some attention must be given to at least the number of people who share that income. Common observation suggests that consumption needs and patterns shift with age and sex so that even households with the same income and of the same size will not generally have the same consumption patterns if their demographic compositions are different. And even if we are primarily interested in the effects of income, for example to establish demand equations for use in forecasting, then it is still necessary to allow for the demographic effects if the influence of income is to be accurately measured. To take a (perhaps) over-simplified example, the budget shares might be put into a regression against (say) the logarithm of total household expenditure instead of per capita household expenditure. Since, over any given cross-section, family size is positively correlated with total family expenditure, the expenditure elasticities will be biased towards unity, that is, downwards for luxury goods and upwards for necessities. In practice, no one is likely to ignore family size quite so completely, but the point remains that, even in order to estimate income elasticities, the demographic effects must be taken into account.

But, of course, the demographic effects are of major interest in their own right and their estimation has just as much claim on our attention as does that of income elasticities. The methodology we suggest in Chapter III is designed to produce, from a first pass through the data, some indication of the main "stylized facts" of household composition on demand patterns. A wide range of important research topics depends, at least in part, on the knowledge of these facts. We describe some of these topics

below, but the current point is not to lay out research programs to resolve these issues but to generate data that cast light upon them. The first stage of demand analysis is essentially exploratory, to discover what, if anything, each data set can say about the effects of children, sex and age on expenditure patterns.

We have already emphasized the importance of budget shares for analyzing the effects of economic policy on individual welfare and hence how the knowledge of variations in budget shares with income is essential for the analysis of the distributional effects of economic policy. The same argument holds for the relationship between household composition and the budget shares. If food shares are higher for households with a large proportion of children, then food price increases will bear disproportionately on such households and hence on children themselves. At a more disaggregated level, the association of particular commodity purchases with particular demographic groups alerts us to the welfare impact of specific price changes. The same also holds for sales. Groups whose livelihood depends on selling one commodity to buy others can be forced into poverty and even starvation by relative price changes if the price of what they sell falls and the price of what they buy rises.

The effects of children on expenditure is also at the center of attempts to measure the "costs" of children. Estimating such costs is important for answering at least two important questions: how should we make welfare comparisons between households with different numbers of members and with different compositions? And what effects, if any, does the cost of

children have on fertility? We look briefly at each of these, if only to highlight the relationship between these major issues and the empirical analysis described later in the volume.

It is a well-known fact that in most household surveys, total household expenditure is positively associated with household size. However, as household size increases, total outlay rises less than in proportion so that if we look not at total household expenditure, but at per capita household expenditure, the latter is negatively correlated with household size. Now, apart from fairly minor modifications, most studies choose either total household expenditure or per capita household expenditure as a measure of economic status and as the basis for inequality measurement. If the total is chosen, then inevitably it is "discovered" that one of the major associates of poverty (and from there it is not far to "cause") is small family size. Other investigators, who choose per capita expenditure find that poverty is typically associated with large family size. And, of course, there is little difficulty in constructing "theories" of why either finding should be true. The question naturally arises as to whether it is not possible to do better than this by deriving some measure of the economic costs of children and additional adults that is derived from measurement rather than from assumption.

The task often appears straightforward. We observe small families and we observe large families and surely the difference in their outlays must be some measure of the costs of the extra individuals? The problem is that such a procedure takes no account of the overall economic position of the two families; the small family might be that of a rich businessman and the large that of a poor farmer, so that the difference in their outlays is only very

partially explained by their different compositions. One might be tempted to restrict the comparisons to households with the same income, but this would not really do either. If incomes are the same, then so must the total of outlays be, at least if saving is included. And if saving is ignored, we are effectively assuming that household composition has no effect on the timing of consumption. The truth is that, given income, different household compositions induce different patterns of demand within the same total outlay; the birth of an extra child does nothing to complement household income but rather causes a rearrangement of purchases, and possibly also of labor supply.

What is required is some rule or criterion which tells us when two households with different compositions have the same welfare, so that comparisons of outlays between such households, so called "equivalence scales", are legitimate measures of the costs associated with the differing compositions. Establishing such a criterion is no easy matter, and the literature on child costs, although containing a number of suggestions, contains no fully satisfactory non-controversial solution. For example, the widely-used Engel methodology is based on the assumption that households with the same share of food in total outlay are at the same welfare level. Some people find this at least superficially plausible, but it is hard to tell a convincing theoretical story which produces such a result, and the child costs calculated using the method are typically far too large. In Chapter IV of this study, we propose a different method for calculating child costs. Like the Engel method, it is based on consumption of food and it is trivially easy to calculate. However, unlike the Engel method, its assumptions are easier to justify, and its estimates of child costs, at around one third of adult costs, are much more plausible.

The relationship between child costs and fertility is another major reason for being interested in demographic effects on demand patterns, though the issues involved are different from those arising in estimating equivalence scales. Equivalence scales have a wider scope since they attempt to summarize the costs of household composition in general, not just of children. We want to know how much less children consume, but also whether or not there are significant economies of scale to several adults living in the same households. When we move to questions of fertility, we are more narrowly concerned with the costs of children, but at the same time the concepts of costs (and benefits) are greatly extended.

Equivalence scales, if they measure anything at all, measure the fairly short-run economic costs associated with the maintenance of and provision for children. Such costs are an important element in fertility decisions, but other long-term and less tangible costs and benefits are often assigned a larger role. For example, much attention is given to the importance of children as old-age insurance for their parents, or as "assets" which spread risk against misfortune, or as means of gaining access to the opportunities available in rapidly developing urban areas. Children are also seen as unpaid family workers, whose product, although important for family welfare, is both hard to define and rarely measured in the standard household survey. Even taking into account possible costs associated with foregone earnings by the mother, and these may be small or non-existent in most poor countries, the net economic balance of children may be positive and this is not inconsistent with net costs on the narrower consumption measure. Whether one counts children as assets or liabilities depends very much on how broad a view of welfare one wants to take.

The analysis of standard household surveys is not particularly well-suited to a study of the relationship between cost-of-children and fertility. Nevertheless, the data will often be extremely suggestive, and the derivation of stylized facts is likely to be a productive input to the debate. To take one example, Caldwell (1982) has argued that the demographic transition is associated with a reversal of the direction of wealth flows, from children to parents in high fertility, low income, traditional rural settings, and from parents to children in low fertility, high income, "westernized" urban societies. Such a broad generalization is not really amenable to testing without a great deal more formalization, but one would expect some of the effects to show up in the relationship between expenditure patterns and family composition. In western developed economies, the high costs of children will appear in those expenditures which are highly children specific. By contrast, in poorer rural economies, the lower specific needs of children and their greater general substitutability as income earning assets would suggest the existence of much smaller impacts on the rearrangement of household budgets.

We note finally that household budgets also contain a good deal of information concerning the relationship between sex and consumption. There is a good deal of (perhaps superficial) evidence to suggest that in some countries at least, there is a systematic discrimination against females in food consumption. The patterns of male-female labor also vary considerably between societies, as well as with the level of development. Again, the effects of this are likely to be detectable in the relationship between consumption patterns and the sex composition of households.

Our third illustrative topic is the relationship between prices and welfare, particularly the construction of price indices, and this is taken up in Chapter V. Virtually all countries calculate and publish price indices and in most the resulting figures play an important role in determining wage rates and other forms of compensation. Price indices are typically weighted averages of individual commodity prices, prices which are themselves regularly observed in shops and markets. One role of household surveys is to provide the weights for these indices. A standard formula would be some variant of the Laspeyres' formula that uses budget shares to weight the price relatives for individual goods. For a price index generally applicable to the whole population, the weights would be average budget shares, but special price indices are sometimes also calculated with weights that are specific to a particular category of consumers, for example, industrial workers, rural laborers, or old people. This sort of calculation can be done systematically using estimated Engel curves. These relate the budget shares to household outlay, to household composition, and to other socioeconomic characteristics so that, if households face more or less the same prices for individual goods, their overall price indices will vary with the weights, and the Engel curves describe this sytematically. It is thus possible to routinely calculate price indices for different types of households and it is particularly interesting to do so when there are large relative price changes in goods whose share sharply differs over different household types. Price changes between necessities and luxuries and price changes involving goods that are heavily consumed by children are the obvious examples.

Even so, conventional price indices only capture a part of the welfare effects of price changes in developing countries. For many

individuals, especially those who are self-employed either totally or in part, price changes affect their incomes as well as their expenditures. For small farmers producing cash crops, the returns to an hour of labor depend crucially on the price of paddy, maize, or whatever. Similarly, the value of individual endowments, whether physical or human, depend on relative prices; a skilled fisherman, with his own boat and nets, may be unable to support himself or his dependents if the price of fish falls relative to the price of rice. Household expenditure surveys only give part of the information required to analyze these cases and a full welfare analysis depends on the availability of fuller information on endowments, on occupation and on the ownership of capital goods.

Other analytical issues can be taken up when the survey collects information on prices. Usually, prices are sampled separately from household expenditures, but given an appropriate design, there is no reason why the two sets of information cannot be matched up. In household surveys where quantities as well as expenditures are measured, and this is not a well-defined procedure for all goods (for example, transport), unit-values can be calculated. These cannot be used directly as prices without allowing for quality variation; for example, unit-values are typically positively correlated with total outlay over different households. However, if the samples of market prices for the price index are matched with the location of the households in the expenditure survey, say, by using a community questionnaire, then price variation can be separated from quality variation. At a descriptive level, this allows a description of regional differences in prices and of the possible welfare improvements that could be brought about by diminishing them, for example, by improving transport. It also allows us to

study the influence of price variation on demand behavior. The knowledge of how such influences operate is again important in any policy concerning pricing, subsidization or the setting of quotas, and, as was the case with demographic variables, allowing for price variation permits an uncontaminated analysis of the effects of income in the Engel curve.

Notes for Further Reading

The major topics introduced here that are dealt with in the later chapters will be more fully referenced in those chapters. The arguments for using total consumers' expenditure (rather than, say, income) as a measure of welfare are presented in Deaton (1980) and are discussed further in the welfare topic study in this series. The early use of household surveys to document the living standards of the poor is surveyed in Stigler (1954), see also Prais and Houthakker (1955), and Brown and Deaton (1972). Engel's (1857, 1895) studies still exert a significant influence to this day, partly through his statement of Engel's Law, that the share of food declines with levels of living, and partly because of the procedure suggested by Engel for comparing the welfare of families with different demographic compositions, (see Chapter IV). The technical issues of collecting survey data in developing countries are discussed in Murthy (1967) with special reference to India, and more generally by Casley and Lury (1981), see also LSMS publications for description of the latest technology.

There is a large literature on the construction of poverty lines and on the measurement of poverty; Sen's (1981) monograph covers the formal material as well as being basic reading for anyone interested in poverty in developing countries. For a more recent, and somewhat more formal treatment,

see Atkinson (1986). The usefulness of household survey data in the evaluation of food policy is something that is only now being properly developed, but see Timmer, Falcon, and Pearson (1983) for a good if informal discussion of many of the relevant issues. The importance of estimated Engel curves in models for projection and planning is elegantly discussed in the context of the Cambridge Growth Project by Stone (1964), and an application of similar methodology to Sri Lanka can be found in Pyatt, Roe et al (1977). Inconsistencies in the patterns of consumption between cross-sectional, time-series, and cross-country data were first documented by Kuznets (1962), see also Deaton (1975), though they have been given much less attention in the literature than has Kuznets' more famous discovery of the constancy of the consumption to income ratio in long-run American data in spite of its tendency to rise with income in virtually all household budget data. An econometric procedure for combining several household surveys to combat the inconsistency problem is presented in Deaton (1985b) and is applied in Browning, Deaton, and Irish (1985).

Economic and non-economic theories of fertility are again a vast area of research. Among the studies that emphasize the role of child costs in determining fertility are Lindert (1978, 1980), Espenshade (1972, 1984), and more broadly, the marvelous book by Caldwell (1982). See Willis (1982) for a brave attempt to turn some of Caldwell's ideas into a formal model. Sex bias has been studied by Sen (1984) and by Kynch and Sen (1983); see also Rosenzweig and Schultz (1982) for a hard-nosed neoclassical attempt to explain the bias in the Indian context.

CHAPTER II

A FRAMEWORK FOR DESCRIPTION

Concepts

The starting point for any demand analysis is the expenditure patterns themselves. We take the view that the most convenient variables for analysis are the budget shares, that is the expenditures on a good or a group of goods as a fraction of total expenditure. For some purposes, for example, for the analysis of nutrition or for painting a detailed picture of poverty, the quantities consumed are the variables of interest, but for general demand analysis, the shares are often more convenient. They are dimensionless, so that, although they will vary with prices, incomes and living conditions, they can be compared across households, across time, and across countries without the need for price or exchange rate conversions. The shares also add up to unity by construction so that attention is continually drawn to the allocation of the total budget they represent. In this study, we use the symbol w_i to denote a budget share where the subscript i denotes the good to which it refers. Hence if q_i is the quantity consumed of good i, p_i is its price and x is total expenditure, the budget share is defined by the identity:

$$w_i = p_i q_i / x \qquad (2.1)$$

The first use of the survey results is to give an overall picture of consumption patterns using the budget shares. There are two distinct ways to do this. In the first, which corresponds to the national income methodology,

the survey is used to estimate expenditures on each good in the country as a whole; these are then added up to give total consumers' expenditure in the economy. Average budget shares can then be derived by taking the various ratios of the aggregate expenditures to aggregate total expenditure. Formally, if an h superscript denotes a household, these aggregate budget shares can be written:

$$\tilde{w}_i = \sum_h p_i q_i^h / \Sigma\Sigma_{hk} p_k q_k^h \qquad (2.2)$$

where the sums over h are taken over all households in the economy. (Note that these are <u>not</u> sums over all the households in the <u>survey;</u> stratification must be allowed for in estimating the population totals.) It is worth noting that (2.2) is not altered if top and bottom are divided by H, the number of households in the economy, so that the shares can be derived as ratios of <u>per capita</u> (or per household) expenditures.

The second methodology, and the one which we believe is preferable, is to compute the budget shares for each household and then to average over all households. Since these are "direct" averages, we denote them by $\bar{w}_i$ so that

$$\bar{w}_i = \sum w_i^h / H \qquad (2.3)$$

The justification for (2.3) is that our basic interest is in the individual households and each household's expenditure pattern is given an equal weight, that is, 1/H, in computing the overall mean. By contrast (2.2) can be rewritten as:

$$\tilde{w}_i = \sum_h \frac{x^h}{x} \cdot w_i^h \qquad (2.4)$$

where $X = \sum_h x^h$ is total community consumers' expenditure. In this formula, each household is weighted in proportion to its total consumption outlay, so that better-off households get greater weight than poorer households. Since by definition, luxuries are those goods for which the budget shares are higher for better-off households, and vice versa for necessities, w_i will be greater than $\bar{w}_i$ if good i is a luxury and less than $\bar{w}_i$ if good i is a necessity. The difference between the two can be quite large if the distribution of income is unequal. To take an extreme example for illustration. Imagine an economy with one million very poor consumers, each of whom spends all of his or her resources on food and who, between them, possess only 20 percent of the country's income. There are also one hundred rich consumers, who earn 80 percent of total income, and who spend only 5 percent of their budget on food. The simple average of the food budget shares $(\bar{w}_i)$ is 99.99 percent whereas the national income methodology $(\tilde{w}_i)$ gives a figure of only 24 percent. Although this is an extreme example, we believe that, in general, the former is the more useful descriptive statistic.

Illustrative Numbers from Three Surveys

Tables 2.1, 2.2, and 2.3 are illustrative of the descriptive tabulation of the disposition of income and expenditures that can be done immediately after the survey results have been cleaned and collated. These are based on three illustrative surveys, the 1969-70 and the 1980-81 Socioeconomic Surveys of Sri Lanka and the 1978 SUSENAS survey of Indonesia. All three surveys, as is usual, are stratified. In the Sri Lankan cases, there are three strata. The urban/rural dichotomy is standard enough, but the third, estate, sector calls for brief comment.

These estates, largely tea estates, are economically, racially and physically distinct from the rest of the island. The workers are of Indian Tamil stock, they are typically very poor with relatively little inequality, they have rather small families, atypically poor housing conditions, few opportunities for own-account cultivation, and are employed, both men and women, exclusively on the estates. In Sri Lanka, they form a natural third sector for analysis which we expect to look rather different from the other two.

The 1969-70 Sri Lanka survey covered 9,663 responding households, 4,022 from urban areas (population 375,000 households), 3,652 from rural areas (population 1,696,000) and 1,990 from the estates (population 302,000); note the unequal sampling weights, again a common feature given the cost differences in collecting the data. The 1980-81 survey has 5,035 responding households, 1,014 urban (population 570,000), 3,639 rural (population 2,264,000) and 382 estate (population 224,000). The Indonesian survey is stratified more conventionally, both by urban and rural, and by geographic region, into Java on the one hand and the Outer Islands on the other. There

are 6,351 households in total, 1,057 in urban Java (which contains 11 percent of the country's households), 1,336 in rural Java (55 percent), 1,771 in urban non-Java (6 percent), and 2,187 in rural non-Java (28 percent).

Use of these three surveys, here and in the following chapters, allows us not only to examine the economic evolution of one country and the change in the welfare of specific groups within its borders, but also to compare the relative living standards and economic behavioral patterns of households in two different countries.

The first tables give budget shares for various commodity groupings, both by sectors, and for the whole economy. Proportions of households who made non-zero purchases are also shown, as are the standard deviations of the budget shares (including the zeros). Note that zero consumption of a good may be an indication that the household never buys the good (for example, alcohol in Indonesia), or that it simply happened not to do so over the period of the survey (for example, clothing). Some goods, for example transport, may be infrequently purchased by some households and never purchased by others.

The tables also give the averages of per capita expenditure, and per capita income. The income and implied savings figures should be treated with great caution because of likely understatement of income and possible overstatement of consumption.

TABLE 2.1: **The Disposition of Income and Expenditure: Sri Lanka 1969-70**

	Urban mean share (std dev)	p	Rural mean share (std dev)	p	Estate mean share (std dev)	p	All Island mean share (std dev)	p
Food	61.4 (13.8)	1.0	66.2 (11.8)	1.0	67.6 (11.5)	1.0	65.4 (12.3)	1.0
Liquor and Tobacco	5.1 (5.4)	.848	6.8 (6.0)	.960	8.0 (5.3)	.986	6.6 (5.9)	.941
Housing	10.3 (8.2)	.997	6.3 (4.1)	.999	4.6 (3.2)	.998	6.9 (5.3)	.998
Fuel	4.0 (1.8)	1.0	3.8 (1.9)	.999	3.6 (2.5)	1.0	3.8 (2.0)	.999
Clothing	5.7 (7.9)	.562	6.0 (8.0)	.571	8.5 (10.1)	.594	6.1 (8.2)	.571
Household	3.3 (2.7)	.993	2.5 (2.1)	.992	2.2 (1.4)	.994	2.6 (2.2)	.992
Health	2.8 (3.1)	.986	2.7 (3.4)	.969	1.8 (2.7)	.912	2.6 (3.3)	.968
Transport	2.5 (2.7)	.891	2.5 (2.9)	.855	2.0 (2.4)	.812	2.5 (2.8)	.858
Recreation	3.2 (4.6)	.768	2.0 (4.4)	.596	1.0 (2.6)	.453	2.1 (4.4)	.617
Durables	1.6 (4.3)	.306	1.4 (3.8)	.299	1.0 (3.2)	.151	1.4 (3.9)	.289
Average PCE*	79.2 (54.9)		56.1 (30.4)		54.1 (27.6)		60.1 (36.3)	
Average PCI*	88.5 (98.6)		54.5 (34.2)		49.1 (29.2)		60.3 (51.9)	

*Measured in Rupees/month with standard deviation in parentheses.
Source: Sri Lanka Socioeconomic Survey, 1969-70.

TABLE 2.2: **The Disposition of Income and Expenditure: Sri Lanka 1980-81**

	Urban mean share (std dev)	p	Rural mean share (std dev)	p	Estate mean share (std dev)	p	All Island mean share (std dev)	p
Food	66.67 (13.23)	1.0	70.79 (10.61)	1.0	73.34 (8.07)	1.0	70.17 (11.16)	1.0
Liquor and Tobacco	3.92 (5.12)	.686	4.66 (4.74)	.865	5.86 (4.25)	.896	4.59 (4.81)	.833
Housing	7.35 (7.47)	1.0	4.07 (3.83)	1.0	3.08 (2.06)	1.0	4.63 (4.85)	1.0
Fuel	5.72 (3.04)	.998	6.42 (2.96)	1.0	6.55 (2.51)	1.0	6.30 (2.96)	.999
Clothing	3.74 (4.08)	.802	3.97 (3.55)	.854	4.50 (3.54)	.870	3.96 (3.66)	.845
Health	2.65 (2.63)	.950	2.72 (3.48)	.932	1.95 (2.18)	.921	2.66 (3.27)	.935
Transport	4.37 (7.26)	.739	3.04 (4.90)	.759	1.65 (2.51)	.663	3.21 (5.36)	.750
Recreation	2.18 (3.85)	.642	1.39 (2.82)	.557	0.86 (2.15)	.429	1.51 (3.03)	.565
Communication	0.22 (0.62)	.354	0.08 (0.23)	.263	0.06 (0.15)	.197	0.11 (0.34)	.276
Household Goods	3.19 (4.41)	.985	2.85 (3.93)	.987	2.16 (1.44)	.983	2.88 (3.93)	.986
Average PCE*	322.51 (247.8)		241.72 (169.5)		218.61 (113.3)		255.50 (186.9)	
Average PCI*	278.84 (336.1)		186.91 (175.3)		189.43 (110.6)		204.34 (215.3)	

*Measured in Rupees/month with standard deviation in parentheses.

Source: Sri Lanka Socioeconomic Survey, 1980-81.

TABLE 2.3: **The Disposition of Income and Expenditure: Indonesia 1978**

	Urban Java mean share (std dev)	p	Rural Java mean share (std dev)	p	Urban Outer Islands mean share (std dev)	p	Rural Outer Islands mean share (std dev)	p	All Indonesia mean share (std dev)	p
Food	57.89 (24.78)	1.0	71.24 (36.12)	1.0	67.81 (8.80)	1.0	75.37 (13.63)	1.0	70.75 (10.94)	1.0
Liquor	0.02 (0.56)	.01	0.05 (2.80)	.01	0.10 (0.62)	.03	0.23 (1.60)	.05	0.10 (0.83)	.02
Tobacco	5.32 (10.19)	.68	5.06 (15.82)	.82	6.10 (4.33)	.73	5.62 (5.96)	.82	5.31 (4.44)	.80
Housing	14.34 (20.68)	1.0	3.59 (15.87)	1.0	10.26 (5.75)	1.0	5.62 (6.53)	1.0	5.71 (6.22)	1.0
Fuel	5.61 (5.90)	1.0	9.34 (16.69)	1.0	4.40 (2.08)	1.0	3.59 (3.60)	1.0	7.04 (4.47)	1.0
Household Goods	7.72 (11.77)	.97	3.55 (18.24)	.87	5.16 (4.16)	.95	2.73 (4.82)	.86	3.87 (4.91)	.88
Transport	3.16 (9.50)	.46	0.63 (8.50)	.11	0.91 (2.15)	.22	0.25 (1.56)	.08	0.81 (2.61)	.15
Clothing	4.34 (8.96)	.98	5.26 (20.15)	.95	4.34 (3.49)	.94	5.28 (8.12)	.93	5.11 (5.39)	.95
User Taxes	1.60 (3.98)	.83	1.27 (9.80)	.61	0.94 (1.44)	.51	1.31 (3.95)	.44	1.30 (2.59)	.58
Average PCE*	10011 (10892.1)		3881 (2505.9)		8069 (5793.7)		6095 (3973.9)		5406 (5173.3)	

Source: SUSENAS 1978.

Even these rather basic data tell us a great deal about the characteristics of the society and about the patterns of luxuries, necessities and the incidence of poverty. Looking first at Sri Lanka in 1969-70, note the dominant part in the budget of the food share, from 61 percent in the cities to 68 percent in the estates. Note too that this ordering is the inverse of the ranking according to per capita expenditure (PCE); both criteria rank the estates as the poorest sector with the urban sector as the best-off. There is substantially more inequality in the cities, whether judged by the standard deviation of the food share in relation to its mean or by the same statistic for PCE. The 30-40 percent of expenditure not devoted to food is spread relatively equally over the other nine categories. In the urban sector, housing is the second most important item of expenditures; housing, clothing and liquor are about equally important in the rural sector; in the estates, liquor and clothing come second, reflecting the relative cheapness (and low quality) of estate-provided housing. Such patterns and rankings are characteristic of very low income economies.

Turning to the proportions of households that make positive purchases, virtually all households purchase food, housing, fuel, household goods, health and, except in the cities, liquor. The vast majority of households spend something on transport, even on the estates; clearly such expenditure is not avoidable, even by the very poorest households. The proportion of households making recreational expenditures varies dramatically across the sectors, as does its share in the total; the same is true of durables although, even in the cities, only 31 percent bought such goods at all in the previous year. This first look at the data suggests that both goods are luxuries, although the availability of various types of recreational

goods is also likely to have been important. Clothing is purchased by about 60 percent of households; such a figure reflects the length of the survey recall period, not the fact that 40 percent of households do not buy clothes. Finally, it is worth noting the variation in shares over households within sectors. Food and fuel have the lowest coefficients of variation, as would be expected of necessities. The high variation goods are also the luxuries (that is, durables and recreational expenditures) and clothing (where timing of purchases is important), with health and liquor expenditures in an intermediate position. Notice that goods with high variation are also those purchased by relatively few households; the censoring of the distribution at zero tends to cause bimodality and high variation.

Table 2.2 presents the budget shares of various commodities for the Sri Lanka 1980-81 survey. Although only the disposition of non-durable expenditures is presented in Table 2.2, the patterns revealed are similar to those of the earlier survey: food accounts for approximately 70 percent of average household expenditure, with three categories, liquor and tobacco, housing, and clothing, accounting for the majority of the remainder. The estates continue to be distinguished as the poorest sector, whether measured by the share of total expenditure devoted to food (73 percent in the estates, compared to 71 percent for the rural and 67 percent for the urban sectors) or by the average PCE, where the estates lag the rural and urban sectors by 11 percent and 48 percent respectively. As was true in the earlier survey, the lowest coefficients of variation are displayed by food and fuel, necessities purchased by all households during the sample period, and the highest by communication, recreation and transport.

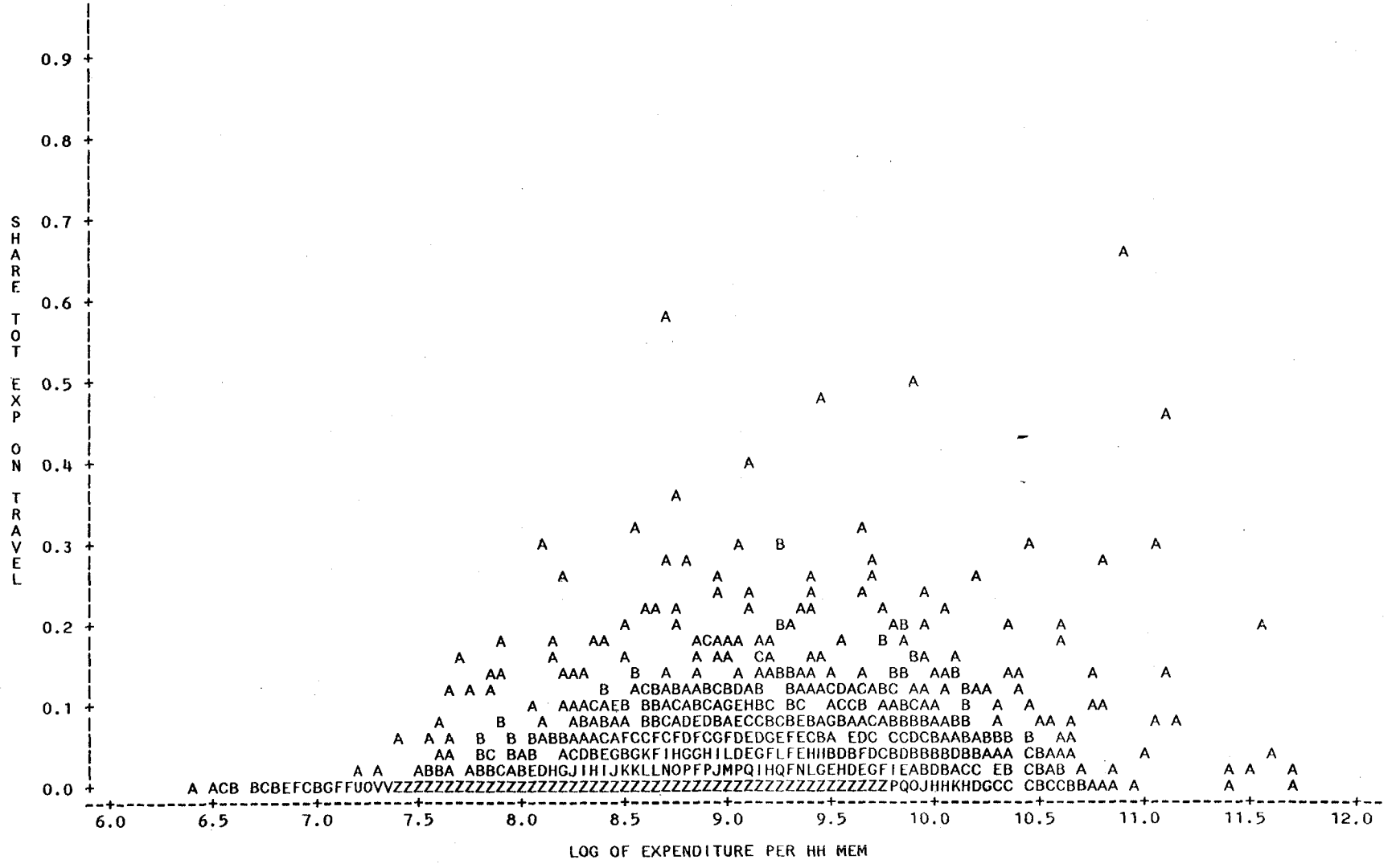
A comparison of Tables 2.1 and 2.2 suggests that within the decade bounded by the surveys, households in all three sectors may have experienced declines in their living standards. Food shares increased on average from 65 percent in 1969-70 to 70 percent in 1980-81, with approximately a 5 percentage point increase in each sector. The change in food share yields a rule of thumb estimate of the change in real PCE. Empirically, the change in the food share has been found to equal approximately -15 percent of the change in lnPCE, (see Chapter III for further discussion). Hence, disregarding changes in relative prices, or the possible effects of changes in rationing schemes, a 5 percent increase in food share suggests an approximate decline in real PCE of 30 percent. The shares of fuel and transport also increased, with fuel rising from 3.7 percent to 6.3 percent of total non-durable expenditure, and transport from 2.4 percent to 3.2 percent. These increases correspond to a decline in the expenditure shares of all other goods; the shares of housing, clothing, recreation, liquor and tobacco each fell roughly by 30 percent of their 1969-70 figures.

There are many possible reasons for these shifts. If nominal incomes did not keep pace with price increases, the resulting real income losses would make themselves felt in living standards measures. Thus increases in fuel and transport shares may be a reflection of the oil price increases in the 1970s. Further, changes in the Sri Lankan food rationing system during the decade may, in part, be responsible for the marked increase in food shares. In addition, the seasons in which the second survey was administered may have biased the fuel and food shares: while the 1969-70 survey averaged one whole year, the 1980-81 data comes only from October-December 1980 and January-April

1981; there may therefore be seasonal effects. A check of the 1969-70 survey, however, showed little variation in expenditure shares by time of year.

In spite of somewhat different definitions, Table 2.3 can be employed to note many of the similarities and differences between Sri Lanka and Indonesia. In Indonesia, once again food accounts for the dominant share of expenditure, and the country average of 70.8 percent is almost identical to that of the later Sri Lankan survey. The share is again lower in urban areas, and higher in the poor regions. However, in Indonesia, there appears to be greater disparity between sectors. The urban Javanese food share is a full 20 percent below the national average. In contrast, note than in Sri Lanka 1980-81, the greatest differences between any one sector's food share and the national average was the 5 percent difference for the urban sector. One of the major differences between the two countries is in the travel category. Overall in Indonesia, only 14.5 percent of households registered travel related expenditures; the corresponding Sri Lankan figure for 1969-70 was 85.8 percent. In urban Java, the average travel share was 3.2 percent. However, given that half of the urban Javanese recorded zero purchases, we know that many households spent a significantly greater proportion of their budgets on travel than the urban average suggests. This is confirmed both by Figure 2.1, which shows the relationship between the share of expenditure devoted to travel and PCE, and where it can be seen that a noteworthy number of households allocated between 5 percent and 15 percent of their expenditures on travel.

FIGURE 2.1: **Share of Expenditure on Travel and ln(PCE): Indonesia 1978**



Note: 3676 Observations hidden at Share of travel = 0.

Legend: A = 1 OBS
B = 2 OBS, etc.

Source: SUSENAS 1978

Returning to Table 2.3, note that almost no Indonesian households purchase alcohol (or at least confess to doing so); Java is almost entirely Muslim, the rest of the country largely so. Housing takes up a higher share of the budget in urban areas, as is the case in Sri Lanka while other expenditure items, namely tobacco, fuel, household goods (which here include health expenditures) and clothing, also conform to the patterns discussed above.

The food shares shown here for Sri Lanka and Indonesia are typical for poor countries so that much of the interest in household budgets attaches to the allocation of food expenditure itself. Table 2.4, for the Indonesian survey, is reproduced from Chernichovsky and Meesook (1982) and shows the breakdown of the food share into its components with disaggregation by regions, by urban and rural, by seasons, and by expenditure class. Chernichovsky and Meesook describe these figures as follows:

> The urban population spends proportionately less on rice, corn, and cassava (the main staples) than does the rural population, and more on meat and poultry, eggs, milk, legumes, fruits and "other" foods. Similarly, the lower 40 percent allocates more of its budget to the staple foods than do the other expenditure groups, while the upper 30 percent spends relatively more on fish, meat and poultry, eggs, milk, and "other" foods. Within staples, the rural population spends a smaller proportion on rice and larger proportions on corn and cassava. The share of staples in the food budget declines while the share of rice within the staple group increases with rising incomes.

They then go on to discuss the variations in shares by region (major) and by season (minor).

TABLE 2.4: **Proportions of the Food Budget Allocated to Different Food Groups: Indonesia 1978**
(%)

	Rice	Corn	Wheat	Cassava	Potatoes	Fish	Meat and Poultry	Eggs	Dairy Products	Vegetables	Legumes	Fruits	Other
Indonesia	33.90	3.65	0.61	1.88	0.74	6.56	2.48	1.07	0.72	7.30	3.16	2.53	35.40
Region													
DKI Jakarta	21.52	0.09	0.13	0.28	0.46	5.30	4.06	2.59	2.73	6.90	4.15	3.74	48.05
West Java	44.24	0.72	0.19	1.09	0.57	6.80	2.15	0.91	0.66	5.55	2.76	3.09	31.27
Central Java	33.73	7.40	0.48	2.44	0.51	2.38	1.19	0.64	0.47	7.98	3.80	1.63	37.36
DI Yogyakarta	25.93	2.11	0.29	2.90	0.20	0.47	0.83	0.97	0.69	9.31	3.81	1.50	50.99
East Java	27.79	7.34	1.28	3.32	0.43	4.68	2.16	1.01	0.41	7.95	4.96	1.67	37.01
Sumatra	35.00	0.15	0.32	1.10	0.99	9.94	3.36	1.35	0.96	8.50	1.79	2.81	33.72
Bali and Nusatenggara	34.39	5.46	0.96	1.56	1.82	5.42	5.40	0.99	0.28	7.03	1.93	2.82	31.93
Kalimantan	30.11	0.23	0.51	1.12	0.52	12.99	3.06	1.39	1.03	6.90	1.83	3.49	36.82
Sulawesi	31.87	2.95	0.94	1.34	1.67	13.18	2.70	1.19	0.93	5.67	1.54	4.02	32.00
Maluku and Irian Jaya	17.29	0.13	0.71	4.98	4.01	15.40	1.65	1.08	2.50	9.11	2.20	3.74	37.19
Location													
Urban	27.89	0.40	0.25	0.50	0.53	6.90	3.91	2.03	2.03	7.20	3.85	3.39	41.12
Rural	35.11	4.31	0.68	2.16	0.78	6.50	2.19	0.87	0.45	7.32	3.02	2.36	34.25
Season													
February	32.97	5.45	0.99	2.04	0.72	6.34	2.13	0.97	0.73	7.11	3.08	2.80	34.65
May	33.77	3.02	0.43	1.70	0.66	6.73	2.13	1.12	0.66	7.67	3.23	2.48	36.40
November	35.02	2.43	0.40	1.91	0.84	6.62	3.23	1.10	0.76	7.10	3.17	2.29	35.13
Expenditure Class													
Lower 40 %	36.29	6.41	0.82	2.80	0.77	5.88	0.86	0.59	0.14	8.04	2.75	1.67	32.99
Middle 30%	36.86	2.68	0.48	1.65	0.69	6.75	2.04	0.96	0.49	7.05	3.14	2.42	34.78
Upper 30 %	28.01	1.15	0.47	0.96	0.74	7.24	4.94	1.77	1.66	6.62	3.68	3.71	39.04
Nutritional Status													
Calories: Deficient	34.73	5.50	0.68	1.73	0.60	5.64	1.71	0.37	0.53	7.40	3.31	3.28	35.39
Not Deficient	32.91	1.45	0.52	2.07	0.90	7.66	3.40	1.29	0.93	7.19	2.97	1.90	35.42
Protein: Deficient	35.43	6.52	0.67	2.78	0.65	4.41	1.06	0.66	0.28	7.58	2.75	3.14	35.62
Not Deficient	32.89	1.76	0.57	1.29	0.80	7.98	3.42	1.33	1.00	7.12	3.44	1.60	35.26
Vitamin A: Deficient	38.75	3.54	0.55	1.80	0.35	6.32	1.86	0.79	0.45	6.02	3.01	3.16	34.78
Not Deficient	29.78	3.75	0.66	1.95	1.07	6.77	3.01	1.30	0.94	8.39	3.28	1.78	35.94

Source: SUSENAS 1978 data tapes, Biro Pusat Statistik, Jakarta

Since one of the major covariates of the demand patterns is the size of the household budget, the logical next step in description is to cross-tabulate savings patterns, expenditure shares, and the allocation of the food budget against total household expenditure. There are a number of possible income or expenditure variables that could be used to measure each household's command over resources, but here our preferred measure is household PCE. There are good grounds for taking PCE as a short-run measure of economic welfare (at least as an approximation); it fluctuates over time much less than does income, and it tends to be more easily and more accurately measured than is income. There is also a number of different ways of illustrating the empirical joint distributions between the various magnitudes and PCE. Scatter diagrams of individual observations can be useful, but are clumsy tools with so many observations where patterns are more easily discerned if averages are taken over different income groups. One of the most convenient ways of doing this is to divide households by PCE deciles. By definition, households are equally spread among the ten deciles, and the cross-tabulations tend to convey most of the covariation with income, without either being tied to a specific functional form or swamping the reader in an enormous amount of information.

Table 2.5 shows the ratios of expenditure to income in three surveys discussed by Visaria, for Peninsular Malaysia 1973, for Sri Lanka 1969-70 (the same survey used above) and for Taiwan 1974, and the Sri Lanka 1980-81 survey used above. The A columns show average expenditure to income ratios for the ten deciles of household per capita expenditure while the B columns give the same information where the deciles are defined in terms of per capita income. Although the saving or expenditure ratios differ among countries - the savings ratios in Malaysia and Taiwan are about 15 percent, but the figure

TABLE 2.5: **Expenditure to Income Ratios: Four Surveys**

Decile	Peninsular Malaysia 1973		Sri Lanka 1969-70		Sri Lanka 1980-81		Taiwan 1974	
	A	B	A	B	A	B	A	B
1	0.704	3.683	0.990	1.340	1.347	2.918	0.883	0.996
2	0.869	1.241	1.000	1.247	1.505	1.951	0.879	0.944
3	0.885	1.115	0.995	1.188	1.515	1.720	0.886	0.923
4	0.893	1.070	1.008	1.145	1.596	1.588	0.874	0.921
5	0.925	0.987	1.051	1.100	1.656	1.499	0.864	0.903
6	0.858	0.987	0.996	1.070	1.587	1.421	0.864	0.881
7	0.918	0.882	1.055	1.012	1.626	1.314	0.861	0.858
8	0.871	0.844	1.047	0.976	1.667	1.236	0.852	0.840
9	0.715	0.808	1.038	0.936	1.644	1.136	0.804	0.808
10	0.859	0.581	0.926	0.772	1.620	0.928	0.806	0.706
All	0.845	0.845	1.003	1.003	1.576	1.576	0.849	0.849

Source: Visaria, LSMS Working Paper No. 2;
Sri Lanka Socioeconomic Surveys, 1969-70 and 1980-81.

for Sri Lanka 1969-70 is -0.3 percent and for Sri Lanka 1980-81 is -57.6 percent (almost certainly because of understatement of income and possible seasonal effects, though the more severe (reported) dissavings in the later survey are consistent with the apparent lower real income in the later period though they cannot be fully explained by it) - the picture over deciles is remarkably uniform between the countries. Using income deciles, the saving ratio declines steadily with income, most markedly in Malaysia and least so in Taiwan. However, with expenditure deciles, saving ratios show little variation over the groups. This finding is of course consistent with the view that PCE measures welfare on a longer time scale than does per capita income (PCI). Many households who find themselves in the low PCI deciles are there temporarily, because of illness, unemployment, or a poor harvest. However, because their position is temporary they have assets to fall back on, collateral for loans, or relatively fortunate relatives or friends. They can thus afford to spend more than their earnings to tide them over until good times come again, or until the bad times are permanently established along with a new, lower consumption level. By contrast, households that are poor by the PCE criterion are more likely to be permanently poor and to have therefore adjusted their consumption to their income. For them, as for everyone, some saving is no less or more essential than purchases of other goods. Hence, when ranked by PCE, households save much the same proportion of their income regardless of their ranking.

Finally, we look briefly at patterns of demand by deciles. Table 2.6 gives the "All Island" pattern of expenditure by deciles in the Sri Lankan 1969-70 and 1980-81 surveys. A more systematic formal analysis of these patterns will be presented in the next chapter which deals with the derivation

TABLE 2.6: **A Comparison of Expenditure by PCE Decile: Sri Lanka 1969-70 and 1980-81**

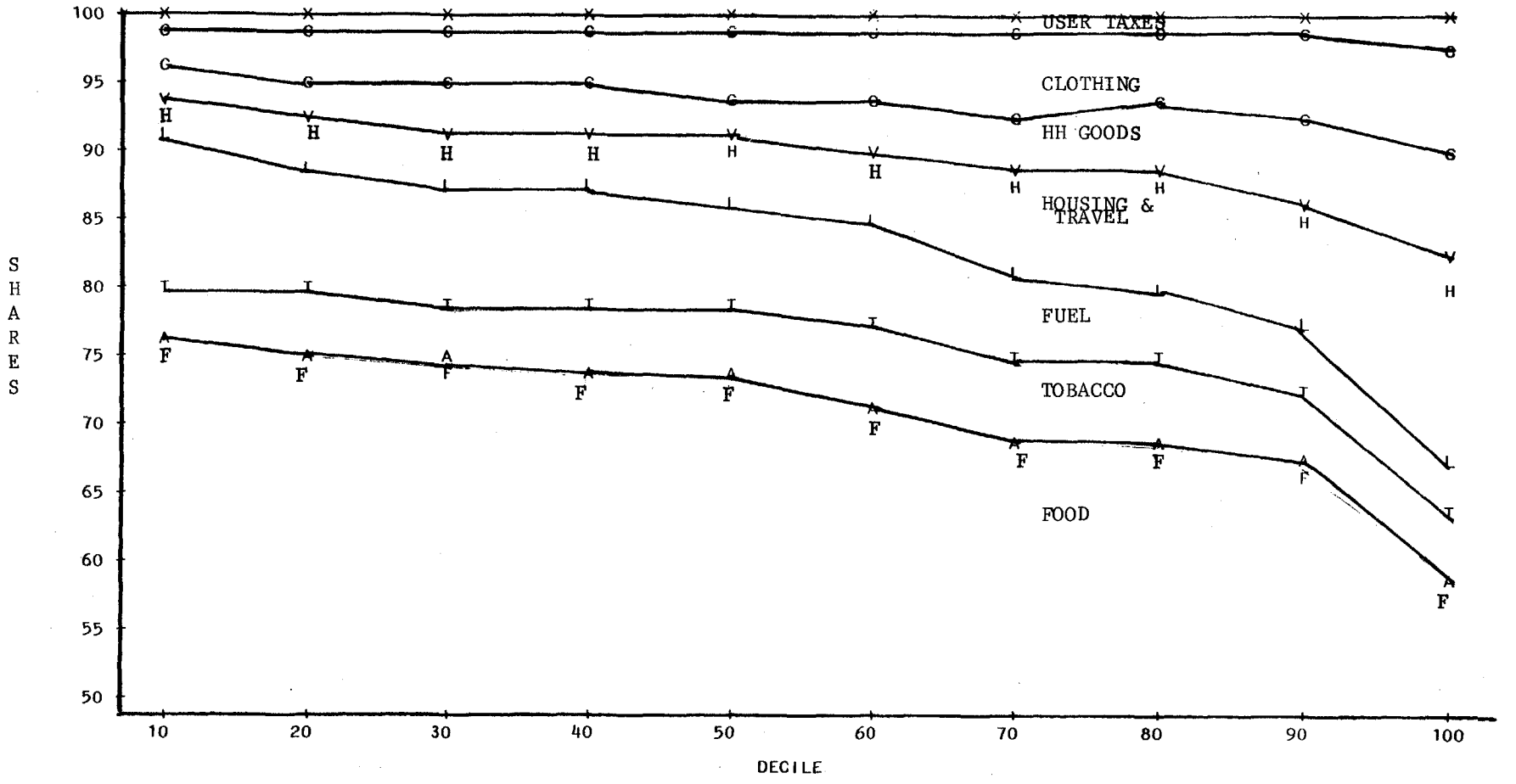
Decile	Food		Liquor and Tobacco		Fuel		Housing	
	1969-70	1980-81	1969-70	1980-81	1969-70	1980-81	1969-70	1980-81
1	75.1	76.0	5.5	3.8	4.3	7.8	5.6	3.6
2	72.3	75.8	5.9	4.1	4.2	6.9	6.1	3.5
3	71.4	74.4	6.2	4.6	4.0	6.9	5.8	3.6
4	69.2	73.9	7.0	4.4	4.0	6.5	5.9	3.7
5	67.7	72.8	7.1	4.5	4.0	6.5	6.2	4.2
6	65.1	71.8	6.8	4.7	3.8	6.1	6.6	4.0
7	62.5	69.7	7.2	5.0	3.8	6.1	7.2	4.5
8	59.8	67.9	6.7	4.7	3.7	6.0	7.8	4.8
9	54.4	64.6	7.2	5.2	3.3	5.4	8.0	5.8
10	46.4	54.4	6.1	5.0	3.1	4.7	11.7	8.5
Mean	65.4	70.2	6.6	4.6	3.8	6.3	6.9	4.6

Decile	Household Goods		Clothing		Health		Recreation	
	1969-70	1980-81	1969-70	1980-81	1969-70	1980-81	1969-70	1980-81
1	1.9	2.1	2.8	2.7	1.9	1.6	1.0	0.7
2	2.1	2.0	3.6	3.0	2.2	2.0	1.1	0.8
3	2.3	2.3	4.4	3.3	2.2	2.1	1.2	0.8
4	2.2	2.3	4.5	3.6	2.5	2.3	1.5	1.0
5	2.4	2.3	5.6	3.7	2.4	2.5	1.6	1.1
6	2.5	2.5	6.7	3.8	2.7	2.9	1.9	1.4
7	2.7	2.7	7.4	4.6	2.7	2.9	2.2	1.5
8	2.9	3.2	7.9	4.5	3.3	3.1	2.9	2.0
9	3.4	3.4	9.8	5.0	3.4	3.5	3.7	2.5
10	4.5	5.9	11.5	5.5	3.6	3.7	5.8	3.4
Mean	2.6	2.9	6.1	4.0	2.6	2.7	2.1	1.5

Source: Sri Lanka Socioeconomic Surveys, 1969-70 and 1980-81.

of Engel curves. However, the main patterns are clear from the table. In the 1969-70 survey, the shares of food and fuel decline fairly steadily, with food share falling from 75 percent in the lowest decile to 45 percent in the highest. Liquor and tobacco maintain a relatively constant share across deciles, while the shares of all other non-food items (led by housing) rise with increases in PCE. These patterns are repeated in the 1980-81 survey, as is evident from the lower portion of the table, and are very similar, in turn, to the patterns revealed by the 1978 SUSENAS survey of Indonesia, presented in Figure 2.2. The information here is much the same as in Table 2.6 but the graphical form allows it to be more rapidly and more easily assimilated.

FIGURE 2.2: **Expenditure Shares by PCE Decile: Indonesia 1978**



Source: SUSENAS 1978

Notes for Further Reading

More detailed analyses of these and other similar data can be found in the papers by Visaria (1980), for a wide range of data sets, and by Chernichovsky and Meesook (1982) for Indonesia. Recent papers by Bhalla (1985), Glewwe and Bhalla (1985), and Anand (1985) attempt to sort out what has actually happened to living standards in Sri Lanka since 1969; the task is a very complex one and is beyond the scope of an illustrative chapter such as this one. The suspicion that consumption may be overstated in household surveys in LDC's comes from Bhattacharyya's (1963) study in which experiments were carried out with questionnaires of varying amounts of detail. The more commodities identified on the schedule, the more expenditure is reported. Of course, this does not tell us whether the short schedules understate, or the long ones overstate, or whether there is some combination.

CHAPTER III

THE ESTIMATION OF ENGEL CURVES

In this chapter, we present a methodology for the estimation of Engel curves with particular emphasis on the relationship between food demand and per capita household expenditure. The detailed results discussed here come once again from the Sri Lankan 1969-70 and 1980-81 surveys and the 1978 SUSENAS survey of Indonesia.

As in the previous chapter, we take the explanation of the budget shares as our primary task. The simplest possible model of demand that makes any kind of sense is that which treats the budget shares as centered around constants, that is

$$w_i^h = \bar{w}_i + u_i^h \qquad (3.1)$$

where i is a commodity subscript, h is a household subscript, and u_i^h represents the household deviation from the population mean $\bar{w}_i$. Almost all "intelligent laymen" would use (3.1) as a starting point for projection. If we want to know commodity demands in 1990, a sensible first guess is obtained by applying the current expenditure pattern to the projected level of total outlays in 1990. Even in a cross-section, (3.1) is not obviously false for a number of commodities, excluding of course food.

However, even the most cursory inspection of the data, for example those in Table 2.6, shows that expenditure patterns are not the same for rich

and poor households. Hence (3.1) must be extended to take account of the influence of income, total expenditure and so on. Once again, we prefer a measure of total expenditure rather than an income measure. We also deflate by household size, in order to make at least a crude allowance for the greater needs of larger households. At the next stage of analysis, we shall take a more sophisticated approach to demographic composition. The immediate issue, however, is to select a simple functional form that is consistent with the data. There is no reason to suppose that the same functional form will work well for all possible household surveys, but the procedure we adopt here should be flexible enough to allow for this if carefully applied.

Food Shares and Total Expenditure

It is clear from Table 2.6 and Figure 2.2 that the major changes in expenditure patterns with per capita expenditure are in the split between food and non-food. A natural starting point, therefore, is to find a functional form that can account for this split consistently with the data. Figure 3.1 shows the empirical joint distribution of the food share and per capita household expenditure in the Sri Lankan 1969-70 survey. The solid lines are contours of the distribution, hence, the highest point (the joint mode) is around (65 percent, 50 rupees) and the mass tails off to the bottom right. We would expect this sort of picture to be fairly typical; PCE normally has a marginal distribution that is positively skewed while the food share is somewhat negatively skewed although the skewness is much less than for PCE. Given these features, the regression of the food share on PCE will be nonlinear as shown. However, if PCE is approximately log-normally distributed, much of the skewness can be removed by working with the logarithm

of PCE rather than with PCE itself. Figure 3.2 shows the same scatter as Figure 3.1, but now with PCE measured on a logarithmic scale on the horizontal axis. The contours now suggest that a linear regression is appropriate for use with the Sri Lankan data. Scatter plots presented in Figure 3.2 reveal that this also holds true for the Indonesian data although of course, in both cases, much is left unexplained.

We therefore amend (3.1) to read:

$$w_i^h = \alpha_i + \beta_i \ln PCE^h + u_i^h \qquad (3.2)$$

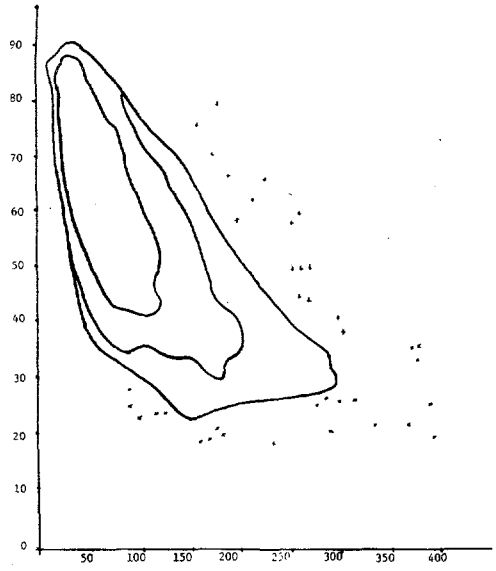
Although this form of Engel curve is often not included in comparative studies, largely because Prais and Houthakker (1955) did not use it, nevertheless it has been recommended, notably by Working (1943) and by Leser (1963). It also has sound theoretical foundations, unlike many of the more popular forms; these are discussed for example in Deaton and Muellbauer (1980). For our current purposes, an important feature of the formulation is that, unlike most other empirical Engel curves, it meets the most obvious requirement of an allocation model that, if applied to <u>all</u> goods in the budget, its predicted budget shares add up to unity. From (3.2), this will happen if:

$$\Sigma\alpha_i = 1 \qquad \Sigma\beta_i = 0 \qquad (3.3)$$

Note too that for those commodities with $\beta_i > 0$, the budget share increases with PCE, for those with $\beta_i < 0$, the share decreases, while if $\beta_i = 0$, the share is independent of PCE. Hence, luxuries and necessities are naturally

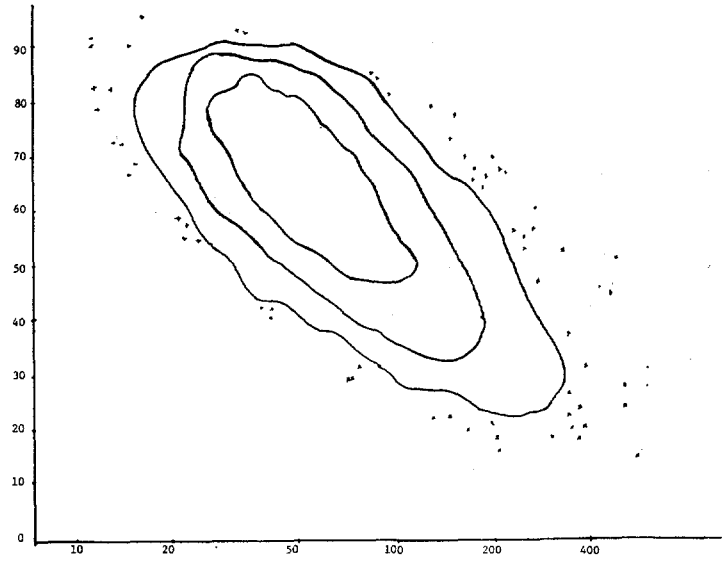
FIGURE 3.1: **Sri Lanka 1969-70**

Food share and PCE



PCE Rupees/month

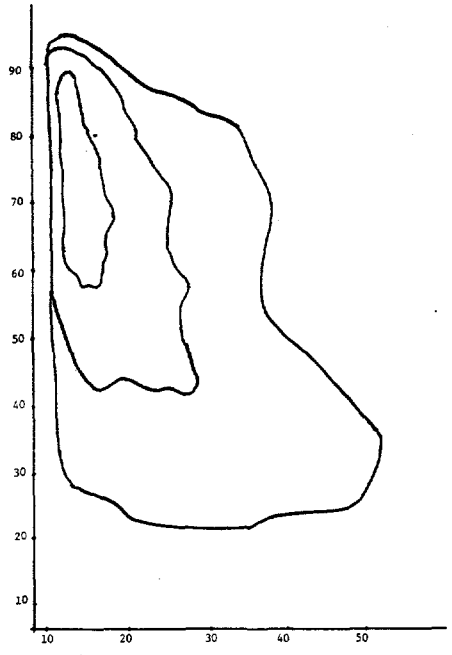
Food share and ln(PCE)



PCE Rupees/month log scale

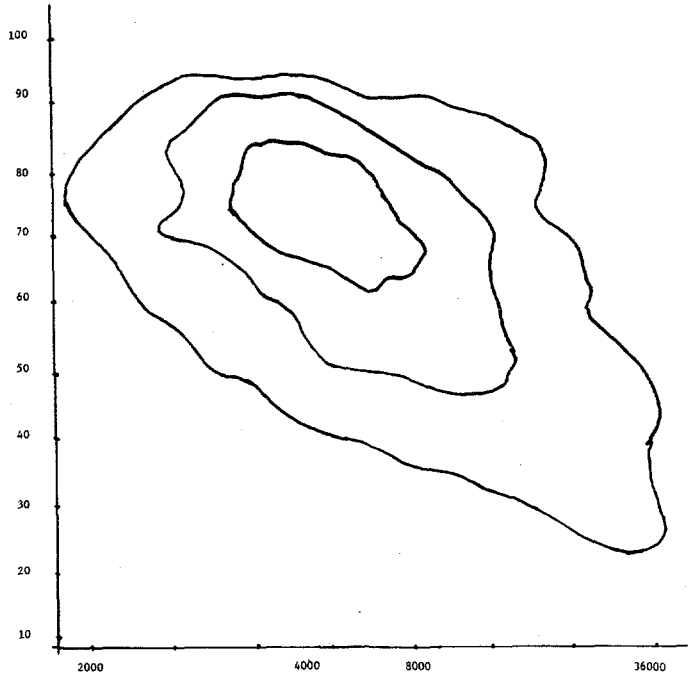
FIGURE 3.2: **Indonesia 1978**

Food share and PCE



PCE '000 Rupees/month

Food share and ln (PCE)



PCE Rupees/month log scale

identified by the model, but perhaps more importantly we see clearly the role of PCE as causing a reallocation of the budget as economic status improves. Note finally that the adding-up conditions (3.3) should ideally hold for the estimated parameters. It turns out to be unnecessary to make any special allowance for this since ordinary least squares estimation (and a wide variety of other procedures) will automatically generate estimates that satisfy (3.3).

Although the β parameters are dimensionless, and so can be compared across time or across countries, it is often convenient (and is conventionally done) to convert the β_i parameters to total expenditure elasticities. This can be accomplished using the formula:

$$e_i = 1 + \beta_i/w_i \qquad (3.4)$$

where e_i is the total expenditure elasticity. Note that these elasticities are not constant as w_i and PCE vary, so that they are usually presented at the sample mean of w_i, where predicted and actual budget shares automatically coincide. The formula (3.4) also implies that, if e_i is not unity, then it falls as PCE increases. This is simply an automatic feature of Engel curves like (3.2) and it may or may not be true in reality. It can be tested by extending the model in a way that we shall describe below.

Engel Curves for the Three Surveys

Tables 3.1, 3.2 and 3.3 present the estimated β-coefficients, (with standard errors) together with expenditure elasticities evaluated at the sample mean for the Sri Lankan and Indonesian surveys respectively. Estimation can be carried out either using all the observations or discarding

TABLE 3.1: β-Coefficients, Standard Errors, and Expenditure Elasticities: Sri Lanka 1969-70

	Urban		Rural		Estate		All Island	
	β (s. e.)	e	β (s.e.)	e	β (s.e.)	e	β (s. e.)	e
Food	-18.58 (0.26)	0.70	-16.00 (0.34)	0.76	-14.08 (0.55)	0.79	-16.08 (0.32)	0.75
Liquor and Tobacco	0.33 (0.15)	1.06	1.41 (0.22)	1.21	1.90 (0.29)	1.24	0.62 (0.20)	1.09
Housing	6.60 (0.20)	1.64	1.19 (0.15)	1.19	-0.58 (0.18)	0.87	3.02 (0.17)	1.44
Fuel	-0.70 (0.05)	0.82	-0.68 (0.07)	0.82	-1.51 (0.13)	0.58	-0.67 (0.07)	0.82
Clothing	4.38 (0.21)	1.77	5.92 (0.27)	1.99	8.90 (0.51)	2.05	5.08 (0.27)	1.83
Household	1.61 (0.07)	1.49	1.12 (0.07)	1.45	0.37 (0.08)	1.16	1.31 (0.07)	1.50
Health	0.78 (0.09)	1.28	1.06 (0.12)	1.39	1.08 (0.15)	1.60	1.02 (0.11)	1.39
Transport	0.83 (0.08)	1.32	1.44 (0.10)	1.58	0.94 (0.13)	1.47	1.22 (0.09)	1.50
Recreation	2.56 (0.12)	1.80	2.38 (0.16)	2.19	1.35 (0.14)	2.35	2.46 (0.14)	2.16
Durables	2.21 (0.12)	2.38	2.15 (0.14)	2.54	1.73 (0.17)	2.73	2.03 (0.13)	2.46

Source: Sri Lanka Socioeconomic Survey, 1969-70.

TABLE 3.2: β-Coefficients, Standard Errors, and Expenditure Elasticities: Sri Lanka 1980-81

	Urban		Rural		Estate		All Island	
	β (s.e.)	e	β (s.e.)	e	β (s.e.)	e	β (s.e.)	e
Food	-15.37 (0.49)	0.77	-10.74 (0.31)	0.79	-5.14 (0.97)	0.93	-11.72 (0.25)	0.84
Liquor and Tobacco	-0.05 (0.27)	0.99	0.89 (0.16)	1.19	-1.75 (0.52)	1.30	0.68 (0.13)	1.15
Housing	5.29 (0.36)	1.72	1.35 (0.13)	1.33	-0.96 (0.25)	0.69	2.25 (0.12)	1.49
Fuel	-2.04 (0.15)	0.64	-1.37 (0.10)	0.79	-1.14 (0.31)	0.83	-1.54 (0.08)	0.76
Clothing	1.75 (0.21)	1.47	1.63 (0.12)	1.41	2.05 (0.43)	1.45	1.68 (0.10)	1.42
Household	2.19 (0.22)	1.69	2.03 (0.13)	1.71	0.48 (0.18)	1.22	2.03 (0.10)	1.71
Health	1.05 (0.13)	1.39	1.35 (0.11)	1.49	0.48 (0.26)	1.25	1.24 (0.09)	1.47
Transport	4.73 (0.35)	2.08	3.53 (0.15)	2.16	1.64 (0.30)	2.00	3.78 (0.14)	2.18
Recreation	2.10 (0.19)	1.96	1.24 (0.09)	1.89	0.73 (0.27)	1.85	1.44 (0.08)	1.95
Communication	0.36 (0.03)	2.64	0.09 (0.01)	2.18	0.10 (0.02)	2.60	0.16 (0.01)	2.48

Source: Sri Lanka Socioeconomic Survey, 1980-81

TABLE 3.3: β-Coefficients, Standard Errors, and Expenditure Elasticities: Indonesia 1978

	Urban Java		Rural Java		Urban Outer Islands		Rural Outer Islands		All Households	
	β (s.e.)	e	β (s.e.)	e	β (s.e.)	e	β (s.e.)	e	β (s.e.)	e
Food	-12.35 (0.47)	0.79	-8.41 (0.60)	0.88	-9.99 (0.46)	0.85	-4.97 (0.38)	0.93	-8.39 (0.24)	0.88
Liquor	0.03 (0.01)	2.25	0.18 (0.05)	4.58	0.07 (0.04)	1.74	0.22 (0.05)	1.94	0.15 (0.02)	2.54
Tobacco	-0.15 (0.25)	0.97	1.46 (0.28)	1.29	0.93 (0.26)	1.15	1.02 (0.17)	1.18	0.96 (0.12)	1.18
Housing	6.86 (0.45)	1.48	2.25 (0.28)	1.63	3.35 (0.33)	1.33	0.37 (0.19)	1.07	2.92 (0.14)	1.51
Fuel	-2.06 (0.13)	0.63	-2.99 (0.29)	0.68	-0.40 (0.12)	0.91	-0.63 (0.10)	0.83	-2.16 (0.10)	0.69
Household	2.69 (0.27)	1.35	2.51 (0.32)	1.71	2.78 (0.24)	1.54	1.08 (0.14)	1.40	2.19 (0.12)	1.57
Transport	2.75 (0.21)	1.87	1.08 (0.15)	2.71	1.31 (0.12)	2.44	0.15 (0.05)	1.60	1.22 (0.06)	2.51
Clothing	1.41 (0.21)	1.32	3.54 (0.34)	1.67	1.55 (0.20)	1.36	2.14 (0.23)	1.41	2.56 (0.14)	1.50
User Taxes	0.83 (0.09)	1.52	0.38 (0.17)	1.30	0.40 (0.09)	1.43	0.62 (0.11)	1.47	0.56 (0.07)	1.43

Source: SUSENAS 1978.

those recording zero purchases. Both procedures can cause bias if there are substantial numbers of zeros, and the results here are based on all the observations. A rough (and somewhat unreliable) correction for bias can be made by dividing the β's by the corresponding proportions of recorded purchases, given in Tables 2.1 to 2.3. Taking the Sri Lankan (1969-70) urban sector as an example, estimated elasticities would become: for transport, 1.36 (rather than the figure shown of 1.32); for recreation, 2.04 (1.80); for clothing, 2.37 (1.77); and for durables, 5.51 (2.38).

Table 3.1 suggests very strongly that, for Sri Lanka in 1969-70, virtually none of the budget shares are constant as PCE changes. All β's, except for liquor and tobacco in the urban sector, are different from zero at a very high level of significance so that all the total expenditure elasticities are different from one. Food and fuel are the two necessities, whose shares in the budget drop with PCE. Additionally, housing is a necessity in the estates, perhaps reflecting the essentially uniform provision of low quality housing to estate workers. All other goods are luxuries and, by and large, the poorer the sector the more luxurious are the luxury goods. The large number of expenditure categories which are accounted as luxuries is again typical of developing countries and is essentially a consequence of the dominant role of food in the budget. For the very poor, everything but food (and fuel) is a luxury.

Although classifications differ slightly between surveys, Table 3.2 reveals patterns for Sri Lanka 1980-81 that are quite similar to those of the earlier survey. Again, the budget shares of all goods change with PCE - with the possible exception of liquor in the urban sector - and, in both surveys, the same goods are identified as necessities, namely food and fuel in all

sectors and housing on the estates. However, while the directions of the anticipated budget reallocations do not appear to have changed between 1970 and 1980, clearly the magnitudes of such reallocations did. This is evident in cross survey comparisons of both the β-coefficients and the expenditure elasticities. As equation (3.4) states indirectly and (3.5) directly, the β-coefficients predict the extent to which the budget allocation of an additional rupee will differ from the present allocation of total household expenditure (THE):

$$\beta_i = \partial(p_i q_i)/\partial(\text{THE}) - w_i \qquad (3.5)$$

Thus the change in the β-coefficient on food (which rose from -16.1 to -11.7 nationally) indicates that households in 1980-81 would be less able to allocate away from food if allowed a marginal increase in expenditure. For the island as a whole in 1970, a 100 rupee increase in total household expenditure would have resulted in an increase in food expenditure of 49 rupees. In 1980, this figure rose to 59 rupees. A second substantial change in the allocation of budgets at the margin occurred in transport; marginal expenditure for this category doubled during the decade, rising from 3.7 to 7.0 rupees. That these "necessities", food and (loosely) transport, claim a significantly larger portion of a marginal increase in household expenditure is again consistent with an overall decline in household living standards between the two surveys. Note that the increases in the marginal propensities to spend on food and transport are offset by declines in luxury items, notably housing, clothing, and recreation.

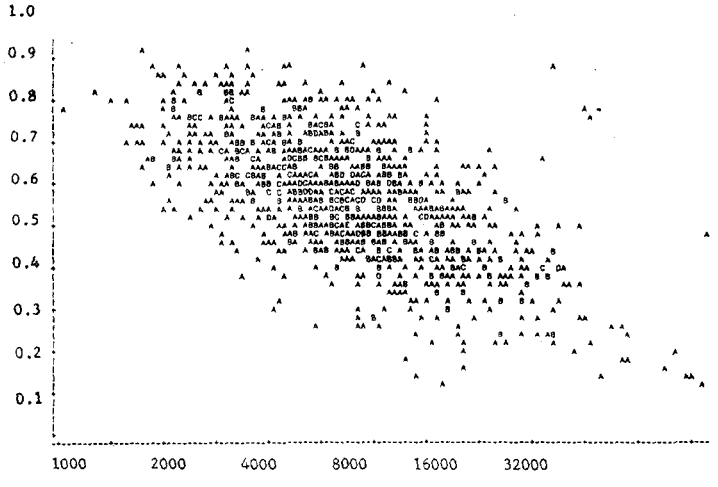
The results in Table 3.3 paint a picture of Indonesia in 1978 which is broadly similar to that of Sri Lanka in 1980-81. As in Sri Lanka, food and fuel are the two obvious necessities and, when discussing the country as a whole, the expenditure elasticities of luxuries observed in Indonesia are roughly the same as those in the later Sri Lankan survey: for housing (1.51 in Indonesia, compared to 1.49 in Sri Lanka 1980-81); for clothing (1.50 to 1.42); for household goods (1.57 to 1.71); for transport (2.51 to 2.18); and that of tobacco in Indonesia (1.18) might be comparable to that of alcohol and tobacco in Sri Lanka (1.15). Alcohol in Indonesia comes out as highly expenditure elastic - presumably religious conventions are only ignored by relatively wealthy individuals.

The Indonesian regression results reveal striking differences in household behavior between sectors. For example, the β-coefficient on food in urban Java (-12.35) is more than twice that of the rural outer islands (-4.97). The scatter plots of food share and ln(PCE) presented in Figure 3.3 indicate why this occurs. In Figure 3.3, note the enormous amount of individual variation which is reflected in the low R^2-statistics that are typical in the analysis of large microeconomic samples such as these. While such randomness is unavoidable, given the idiosyncrasies of household economic behavior, it does not obscure basic patterns of that behavior. For example, in Figure 3.3, it is clear that the food share in urban Java falls more rapidly with increases in PCE and is more closely related to PCE than is the case for food shares in the other sectors. The rural outer islands are at the opposite extreme with a much wider scatter and a less close relationship. These types of diagrams can prove to be extremely useful, both for suggesting

suitable functional form and for aiding the interpretation of both descriptive statistics and regression results.

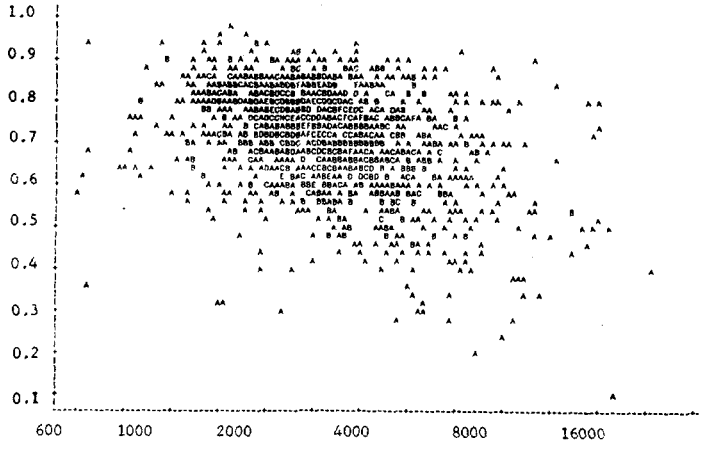
FIGURE 3.3: **Food Share: Indonesia 1978**

Urban Java



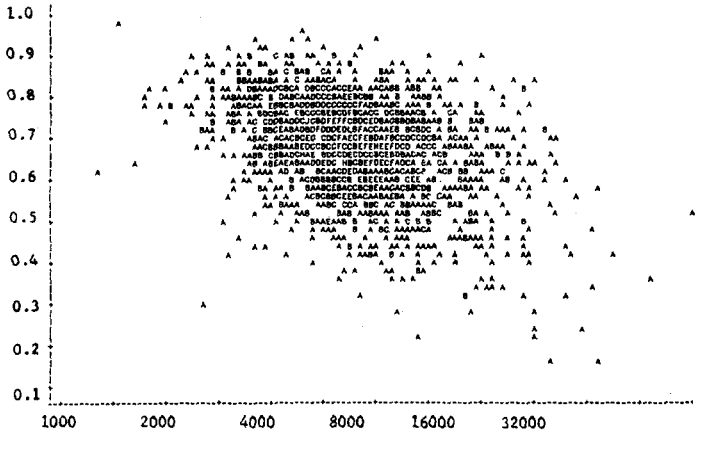
Per capita expenditure log scale

Rural Java



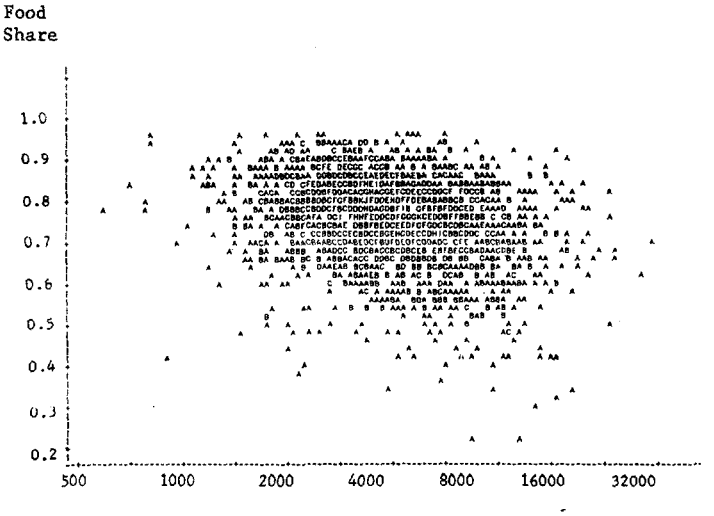
Per capita expenditure log scale

Urban Outer Islands



Per capita expenditure log scale

Rural Outer Islands



Per capita expenditure log scale

Source: SUSENAS 1978

Engel Curves and Household Composition

These results, although helpful in systematizing the role of total expenditure in modifying the household budget, are still very crude. The estimates are likely to be biased, not just by the problems with zero purchases, but also by the omission of a whole host of other factors. Some of these are allowed for in the estimates since additive dummies for seasons and for geographical areas have been included in the regressions. However, no demographic effects have yet been accounted for, nor has there been any allowance for the possibility that the β-coefficients may themselves be functions of per capita expenditure.

It is not immediately obvious how best to allow for demographic structure in improving these estimates. One starting point is to look at the actual demographic structure of households in the sample. An overview of Sri Lanka 1969-70 is given in Table 3.4. Note that one person households were excluded from the sample; although this reduces representativeness, it does so less seriously than would be the case in most developed economies. Note too the general complexity of households. Households with more than two adults are common, representing between 50 and 60 percent of the total. There is also no "typical" household composition; the two adult, no child household is the most numerous in both urban and estate sectors, yet accounts for only 5.4 percent and 11 percent of households (or only 1.7 percent and 4.3 percent of persons). Consequently, it is not practical to analyze each family type separately, as we should need to do a large number of such studies to cover even a majority of households. And, of course, we could create many more household types by disaggregating further on age and sex both of adults and children.

TABLE 3.4: Adult≠ and Child≠ Composition of Sri Lankan Households by Sector (%)

1. Urban

% of households (4022)

No. of Adults \ No. of Children	0	1	2	3	4	≥5	Σ
1	*	0.3	0.2	0.2	0.1	0.2	1.0
2	5.4	4.6	4.9	5.2	3.7	4.8	28.6
3	4.7	3.5	3.3	2.7	2.6	3.0	19.8
4	3.8	3.2	2.9	2.6	1.9	2.7	17.1
5	3.0	2.5	2.1	2.4	1.6	1.9	13.5
≥6	4.3	4.1	3.3	3.1	2.2	2.8	19.8
Σ	21.2	18.2	16.7	16.2	12.1	15.4	100

% of persons (25358)

No. of Adults \ No. of Children	0	1	2	3	4	≥5	Σ
1	*	0.1	0.1	0.2	0.1	0.3	0.7
2	1.7	2.2	3.2	4.2	3.6	5.9	20.8
3	2.3	2.2	2.6	2.6	2.9	4.3	16.9
4	2.5	2.5	2.8	2.9	2.5	4.2	17.3
5	2.4	2.4	2.3	3.1	2.3	3.3	15.8
≥6	4.8	5.2	4.0	5.0	4.0	5.6	28.6
Σ	13.7	14.6	15.0	17.9	15.3	23.6	100

2. Rural

% of households (3652)

No. of Adults \ No. of Children	0	1	2	3	4	≥5	Σ
1	*	0.4	0.4	0.1	0.3	0.2	1.4
2	6.4	5.7	6.7	5.8	4.7	4.7	34.0
3	5.9	3.7	3.3	2.6	2.8	3.6	21.9
4	3.5	3.5	3.1	2.2	2.5	2.9	17.7
5	2.7	2.4	2.3	1.7	1.2	2.1	12.4
≥6	2.7	2.6	2.7	2.2	1.1	1.3	12.6
Σ	21.2	18.3	18.5	14.6	12.6	14.8	100

% of persons (21464)

No. of Adults \ No. of Children	0	1	2	3	4	≥5	Σ
1	*	0.1	0.2	0.1	0.2	0.2	0.8
2	2.2	2.9	4.6	5.0	4.8	6.1	25.5
3	3.0	2.5	2.8	2.7	3.3	5.2	19.6
4	2.4	2.9	3.2	2.6	3.4	4.9	19.4
5	2.3	2.5	2.8	2.4	1.8	3.6	15.4
≥6	3.1	3.4	3.8	3.5	2.3	3.2	19.4
Σ	13.0	14.4	17.4	16.2	15.7	23.2	100

3. Estates

% of households (1989)

No. of Adults \ No. of Children	0	1	2	3	4	≥5	Σ
1	*	0.8	0.6	0.3	0.3	0.0	2.0
2	11.0	8.1	8.3	6.4	4.0	3.7	41.5
3	6.6	3.8	3.5	2.8	1.9	1.2	19.8
4	4.8	3.0	3.2	2.0	1.4	1.5	15.9
5	2.6	2.8	2.1	1.7	1.2	1.0	11.4
≥6	1.5	1.8	1.7	2.0	1.0	1.4	9.4
Σ	26.5	20.3	19.4	15.2	9.8	8.8	100

% of persons (10347)

No. of Adults \ No. of Children	0	1	2	3	4	≥5	Σ
1	*	0.3	0.3	0.2	0.3	0.0	1.2
2	4.3	4.7	6.5	6.0	4.6	5.3	31.4
3	3.8	2.9	3.4	3.2	2.5	2.1	18.0
4	3.7	2.9	3.7	2.6	2.1	2.9	18.0
5	2.5	3.2	2.8	2.6	2.0	2.1	15.4
≥6	1.8	2.6	3.1	4.0	2.2	2.5	16.2
Σ	16.1	16.7	19.7	18.6	13.8	15.0	100

* Single person households were excluded from the sample.

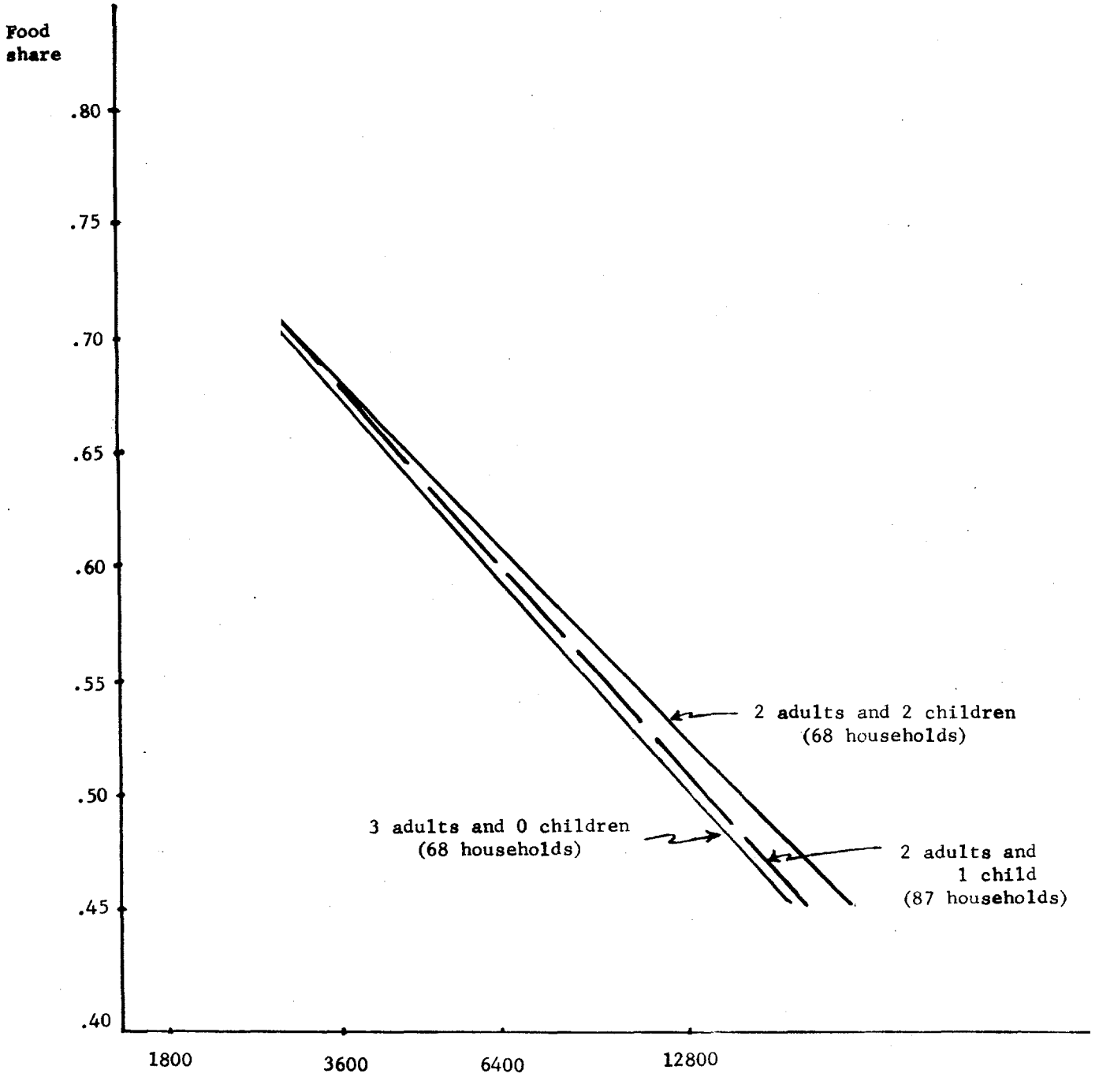
≠ Adults are persons aged 15 or over, children those aged 0-14.

These problems are rather easily resolved both for Sri Lanka and for Indonesia where similar concerns arise. We first studied a number of household types in each country separately, estimating different regressions of the form (3.2) for each. See, for example, the set of regression results for urban Javanese household types from the 1978 SUSENAS survey presented graphically in Figure 3.4. Inspection both of the results presented here and of the results from all other sectors showed that the estimated α and β coefficients for the food/non-food split were remarkably similar across types. In other words, log PCE seems to offer an excellent first approximation to the in principle distinct effects of, on the one hand, total household expenditure, and, on the other, household size and composition. This makes a better approximation straightforward. Once PCE has been controlled for, introducing the demographic variables in virtually any manner will produce rather small coefficients and the precise way in which they are introduced will make little difference to our inferences or conclusion. In particular, a linear specification is obviously convenient and we write:

$$w_i = \alpha_i + \beta_i \ln(PCE) + \Sigma \gamma_{ir} n_r + u_i \qquad (3.6)$$

where n_r is the number of persons in each of R demographic categories, for example, young female children, young male children, and so on.

FIGURE 3.4: **Food Share and ln(PCE) for Selected Urban Javanese Types**



Source: SUSENAS 1978

It is perhaps worth pausing to compare this formulation with others that are more familiar from the literature, if only to explain why we do not adopt the latter. Note first that our starting point, equation (3.2) is consistent with the most elementary model of demographic effects in which per capita expenditures are related to the per capita budget. To see this, multiply through (3 2) by PCE to get:

$$(p_i q_i/n) = \alpha_i PCE + \beta_i PCE(\log PCE) + \text{error terms} \qquad (3.7)$$

so that per capita expenditures are simply a function of PCE.

Such models are at best first approximations, dealing only with the crude head-count and paying no attention to sex or age variations, or to possible economies of scale in household size. The latter can be dealt with following Iyengar, Jain and Srinivasan (1968) by decomposing log PCE into regression. Adapting the idea to the framework used here, we may estimate the model:

$$w_i = \alpha_i + \beta_i \log PCE + \gamma_i \log n \qquad (3.8)$$

If $\gamma_i < 0$, the share of good i decreases with household size even when PCE is held constant, that is, per capita expenditure on the good decreases with household size at constant PCE. This can be thought of as indicating returns to scale in household size for that good. Conversely for $\gamma_i > 0$. But note that the (true and estimated) γ_i's must sum to zero over all the commodities together, reflecting the fact that PCE is PCE whatever the household size. It is not at all clear that this corresponds to the intuitive notion of what is

meant by economies of scale in the consumption context. Almost certainly this reflects an ambiguity in the concept itself and it seems better simply to take (3.7) as an approximation that can be improved by the additional terms in (3.6). Equation (3.6) is selected in this spirit given the Sri Lankan and Indonesian data; we emphasize that we have no reason to expect it to work in general. For each country, one should look at results for specific household types and attempt to find a suitable general model.

Note that in (3.6), the γ_{ir}'s like the β_i's, sum over i to zero and represent the rearrangements of the budget corresponding to different household compositions. One interpretation can be seen by writing:

$$\partial(p_i q_i/n)/\partial n_r = \gamma_{ir}.(x/n) \qquad (3.9)$$

so that, at constant PCE γ_{ir} multiplied by (x/n) represents the effect on per capita household consumption of good i of one more individual of type r. Since we take the γ_{ir}'s to be constants, the model implies that the effects rise proportionately with PCE, reflecting the way in which needs operate through the budget. In a sense, the γ's measure crudely compensated effects of family size; holding PCE constant implies that an increase in numbers is equally matched by an increase in total expenditure, so that the coefficients measure the effects over and above this. Consider, for example, what will happen to family per capita consumption levels if a family receives an extra child together with additional resources equal to the family's previous per capita expenditure level. Note that this a purely hypothetical experiment designed to aid interpretation. Per capita food expenditure will rise if the additional food expenditure is greater than the previous per capita food

expenditure. This is possible but unlikely. There is extra food consumption by the child, and even if children consume mostly food, their total food consumption is typically less than that of adults. There is also likely to be more food consumption by the adults since the additional resources accompanying the child more than compensate for its costs. Even so, the total increment is likely to be less than the previous mean so that, for i (food) and r (children), we should expect γ_{ir} to be negative. For an additional adult, there are also offsetting effects. If the family originally consists only of adults, an additional adult with full compensation should leave per capita consumption levels unchanged, so that the γ's would be zero. However, a family with children typically has a living standard that is understated by its PCE, so that an additional adult with "only" family PCE will reduce living standards overall. If, however, there are economies of scale to larger groups living together, this effect could be reversed. Even so it would be reasonable to expect per capita food consumption to fall somewhat, with the appropriate γ being negative. However, for goods that are more closely associated with adults, this income effect will be offset by the shift in the composition of the household towards adults with corresponding positive γ's.

This is helpful for interpretation, but we also want to know what happens to the budget when household composition changes and total resources are fixed. To see such effects, write:

$$\partial(p_i q_i)/\partial n_r = (x/n).(n\gamma_{ir} - \beta_i) \qquad (3.10)$$

Once again, the larger PCE is, the larger are the effects. Note that the righthand side of (3.10) adds up over goods to zero; additional individuals reallocate the budget, they do not change it.

Equation (3.6) is the basic vehicle for our analysis although there are various modifications in practice. In particular, terms in $(\log PCE)^2$ may be added to deal with any remaining curvature in the relationship; there is no law that says that shares should be an exactly linear function of PCE. Interaction terms between the n_r's and log PCE can also be considered; these permit the responses in (3.6) to vary with log PCE so as to reflect possibly more complex interactions between household composition and income. Seasonal and district effects are typically dealt with by the addition of appropriately defined dummy variables, although for major sectors and regions it will often be desirable to subdivide the sample. Ideally, covariance analysis can be used to determine which responses differ across groups and to what extent it is necessary to go beyond intercept adjustments. However, any given sample is likely to contain a large number of potential groupings, so that the automatic use of covariance analysis is likely to be cumbersome. Instead, it is wise to analyze major subgroups separately from the start, for example urban versus rural, or by race, so that the possible invalidity of pooling does not bias the results from the outset.

Empirical Results for Three Surveys

To report the detailed investigation of equation (3.6) on either Sri Lankan or Indonesian data with a large number of demographic categories, we must discuss commodities one at a time. Of course, the form of the analysis is such as to ensure that the predicted budget shares always add to one so

that positive demographic influences in one position must cancel out somewhere else. But the presentation becomes cumbersome, for example, in Sri Lanka with up to 20 coefficients for each of 10 commodities in 3 sectors. Hence, in this topic study we look only at an expansion of Tables 3.1 to 3.3 to allow for some minimal compositional variables and to give an overall picture of their effects on the structure of the budget. This is done in Tables 3.5 to 3.7 where we have also introduced the quadratic term in the logarithm of PCE so as to allow the β's to vary as the data require.

Regression results shown are from ordinary least squares estimation of equations of the form (3.6) plus a quadratic term in log PCE. While the coefficient on the quadratic term is meaningful in that it tells us the shape and extent of curvature, it proves more useful, in a first look at the results, in presenting a joint measure of the impact of a change in PCE on budget shares, as in equation (3.11):

$$\partial w_i / \partial \ln PCE = \beta_{1i} + 2\ \beta_{2i}(\ln PCE) \qquad (3.11)$$

To allow comparison with the β-coefficients in Tables 3.1 to 3.3, the righthand side of (3.11) is presented in Tables 3.5 to 3.7.

There are only two categories of individuals, the number of adults n_a, and the number of children n_c. For the Sri Lankan regressions, adults are aged from 15-59, children from 0-14, and for Indonesia, children are aged from 0-10. Further categories can be considered and the empirical validity of the simplification tested, see Deaton (1981). Seasonal and regional dummies are included but not shown. The fourth column gives the R^2-statistics, and column 5 shows the F-tests against the null hypotheses in Tables 3.1 to 3.3; the

latter is thus a test of the joint significance of the curvature and the minimal demographic effects. In general, the F-statistics are highly significant in all sectors of all surveys. The final column is an estimate of the total expenditure elasticity evaluated at mean budget shares and mean log PCE.

For all sectors of all three surveys, the elasticity figures differ from those calculated using (3.2) in that they are lower for necessities (food, fuel and housing) and higher for luxuries. As Figure 3.5 makes clear, this is what was to be expected. There, the budget shares predicted with and without the quadratic term are plotted against log PCE for a necessity (fuel) and a luxury (household goods) using results from the urban outer islands, Indonesia 1978. These results are representative of the empirical "fact" that the expenditure shares of necessities are decreasing at an increasing rate at average PCE and the shares of luxuries are increasing at an increasing rate. It is clear from Figure 3.5 that when measured at average PCE and average share the β-coefficients estimated using (3.6) are lower for necessities and higher for luxuries than those estimated with a linear term alone, and the elasticities will differ correspondingly.

In interpreting these results, some features should be kept in mind. The R^2-statistics may appear to be low, particularly for certain commodities and on the Sri Lankan estates. As noted above, this simply reflects the enormous amount of individual variation that is to be expected in large microeconomic samples. If, for example, the data were to be grouped, say by income classes, as is often the case, much of the variation would be removed and the R^2-statistics would be very much higher. The overall significance of the regression can be assessed by F-tests against the null

that the shares are not influenced by any of the variables listed; in all cases the null is very decisively rejected. As to the significance of individual coefficients, a common practice is to set to zero those estimates which are insignificantly different from zero. There is little in the way of formal justification for such a procedure (see for example, Chapter 3 of Judge et al., (1980)), but in the present case it has the additional undesirable feature of destroying the adding-up properties of the estimates which are an essential feature of explaining the pattern of demand. Columns 1, 2 and 3 each add to zero, but this would not remain true if some equations were re-estimated with individual coefficients set to zero. Finally, we add the usual disclaimer about the presence of zero purchases in the calculation of these estimates. We have rerun regressions excluding zeros, and, in a few cases, there are substantial differences, not only in parameter levels, but also in ratios. In particular, conclusions relating to clothing and durables in the Sri Lankan surveys, and those relating to alcohol, transport and user taxes in the Indonesian survey, should be treated as highly provisional.

Turning now to the substantive results, Table 3.5 reveals quite striking patterns associated with the demographic variables for the Sri Lanka 1969-70 survey. We look first at the influence of additional adults, the n_a variable. A useful way to interpret the results is to imagine an already existing household, of several adults and children, which is joined, on a permanent basis, by another adult, who brings with him or her a contribution to household expenditure equal to pre-existing household per capita expenditure. Such an experiment holds per capita expenditure constant so that the coefficients of n_a effect of the extra individual on the budget shares once all adjustments have been made. One possibility is that all effects are

TABLE 3.5: **Quadratic Regressions with Minimal Demographic Effects (zero observations included): Sri Lanka 1969-70**

	Urban						Rural					
	PCE*	Na	Nc	R^2	F-test	e	PCE*	Na	Nc	R^2	F-test	e
Food	-20.04	-0.60	-0.89	.592	74.7	0.68	-17.51	-0.58	-0.73	.644	64.0	0.75
Liquor	-0.10	-0.01	-0.03	.117	5.64	1.03	0.96	-0.18	-0.02	.031	4.42	1.17
Housing	6.53	-0.21	-0.11	.269	51.2	1.53	0.31	-0.22	-0.47	.114	67.8	1.04
Fuel	-0.98	-0.16	-0.20	.165	116.0	0.73	-1.32	-0.21	-0.19	.130	89.8	0.67
Clothing	5.01	0.35	0.43	.166	31.0	1.95	7.20	0.42	0.72	.178	59.8	2.13
Household	1.65	0.08	0.11	.132	29.4	1.44	1.12	0.07	0.09	.083	17.6	1.41
Health	1.15	-0.01	0.02	.023	1.84	1.44	1.09	-0.00	0.06	.034	1.36	1.41
Transport	0.90	0.05	-0.01	.057	8.50	1.40	1.51	0.14	0.05	.083	9.70	1.59
Recreation	3.20	0.38	0.48	.168	93.0	2.04	2.79	0.38	0.33	.121	74.4	2.20
Durables	2.47	0.12	0.20	.104	20.4	2.44	3.03	0.19	0.17	.084	19.6	2.51

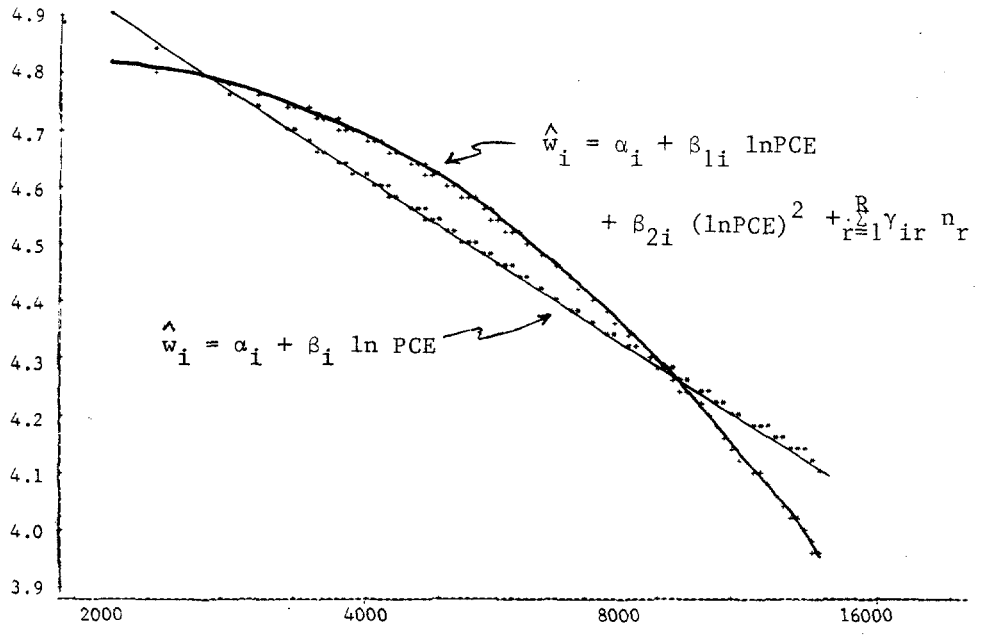
	Estate					
	PCE*	Na	Nc	R^2	F-test	e
Food	-15.02	0.08	-0.35	.282	14.2	0.79
Liquor	1.52	-0.23	-0.09	.049	6.77	1.22
Housing	-2.54	-0.48	-0.63	.178	132.0	0.36
Fuel	-2.32	-0.22	-0.39	.178	66.3	0.31
Clothing	11.14	0.51	1.09	.204	28.0	2.36
Household	0.19	0.02	-0.02	.035	5.78	1.05
Health	1.29	-0.01	0.13	.046	7.60	1.66
Transport	0.79	0.02	-0.00	.051	7.38	1.32
Recreation	1.88	0.16	0.17	.111	30.5	2.66
Durables	2.38	0.14	0.11	.077	13.6	3.11

* The figures shown represent the joint effect of the linear and quadratic ln(PCE) terms: $B_{1i} + 2B_{2i}(\ln PCE)$.

Note: Seasonal and regional dummies were included in the regressions.

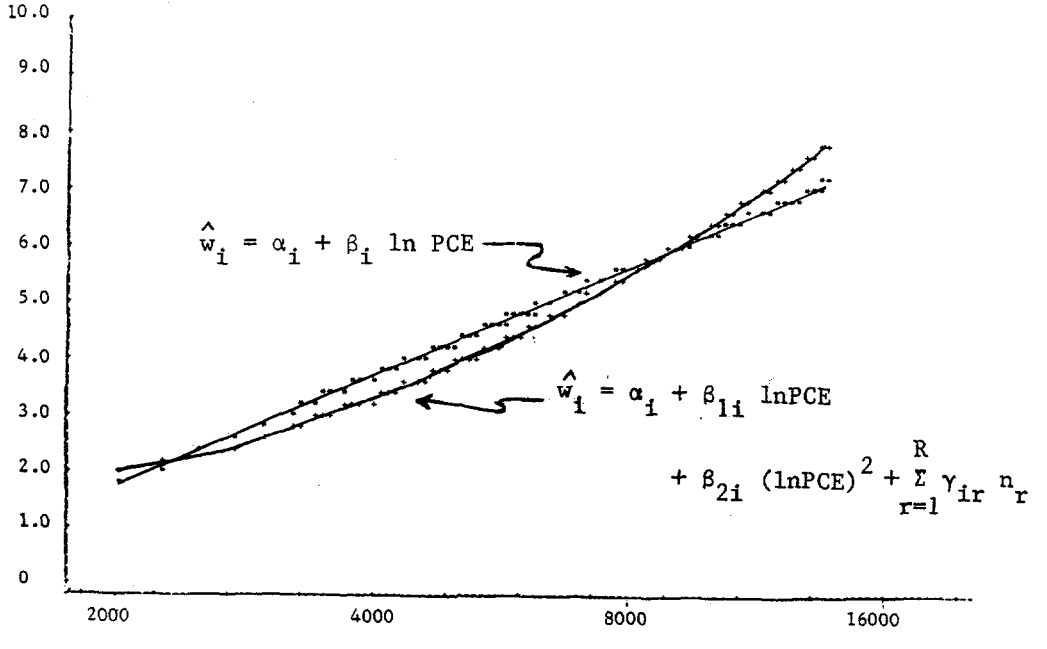
Source: Sri Lanka Socioeconomic Survey, 1969-70.

FIGURE 3.5: **Necessities and Luxuries: A Comparison of Budget Shares Urban Outer Islands, Indonesia 1978**



Predicted fuel share and log PCE

Per capita expenditure log scale



Predicted share of households goods and log PCE

Per capita expenditure log scale

zero so that the household continues to split up its budget in the same way corresponding to its unchanged level of outlay per head. But this is not the case, and the increase in size itself changes the allocation. Looking down the second column for each sector, we see that the extra adult in the urban sector increases the shares of recreation and of clothing with decreases in food, in housing, and in fuel. In the rural sector the pattern is the same with durables and transport also showing increases; food, housing and fuel shares decrease, as in the urban sector, but there the liquor share also falls. In the estates the pattern is repeated except that the food share does not fall; clothing, recreation and durables rise at the expense of housing, fuel and liquor.

The consistency of this pattern across sectors, together with the fact that it is generally the shares of the luxuries which increase while those of necessities fall (but note that housing is classed as a luxury good), suggest that an extra adult, with per capita expenditure held constant, acts very much like an increase in outlay. Put another way, households with more adults have expenditure patterns consistent with a higher standard of living than their per capita outlay would suggest. Such a phenomenon is consistent with the idea of economies of scale to household size. More surprisingly, it is consistent with the hypothesis that all variations in expenditure shares can be explained by "as if" variations in total outlay, whether the variations are due to actual changes in outlay or to variations in household composition.

Note however the anomalous influence of the number of adults on the food share in the estates. One possible explanation is that additional adults in other sectors can produce food on small private plots. If this is not recorded, or undervalued, the food share will apparently fall. In the

estates, however, there is little or no opportunity for such own-account work and a much larger proportion of transactions goes through the market.

There is another, alternative explanation of the observed effects of size. The goods whose shares increase - clothing, durables, and recreational goods - are typically purchased and consumed on an individual basis. Food, housing and fuel, by contrast, are provided on a household basis and, indeed, households are typically defined on the basis of shared accommodation and food. One might then expect shared goods, some of which have a substantial overhead or public element, to be more easily spread over an increase in numbers than private, individual, goods. A cinema ticket gets one person in to see the movie and one person only, but no house is too small to admit one more, and no family so poor that it cannot somehow, feed another mouth. Such an explanation also has the advantage, in light of the empirical results, of not forcing us to regard housing as a necessity.

If we turn now to the effects of children, as shown in Table 3.5, they turn out to be qualitatively very similar to those for additional adults. Once again, families with more children but the same per capita expenditure spend less of their budget on food, housing and fuel (in all three sectors) and spend more on clothing, recreation and durables. Expenditure on household goods also increases in urban, and to some extent, in rural areas. There is also an interesting positive association between health expenditures and the presence of children which is apparently confined to the estates. Broadly speaking, the presence of an additional child (with PCE held constant) has a larger effect on rearranging the budget than does the presence of an additional adult. If we follow the first explanation for the size effects, that of scale economies, this is what we should expect. The PCE

compensation for the child is likely to be overgenerous as compared with that for the adult, so that the income-like effects of the extra child should be correspondingly larger. This is sensible enough but what is somewhat surprising is the relative absence of any strongly specific links between the presence of children and individual expenditures. It is reasonable to suppose that additional children bring with them specific needs as well as a general requirement for more outlay. The latter effect is present, the former is not obviously detectable except possibly for health expenditure in the estates. It is conceivable that the specific needs of children will show up at a greater commodity disaggregation than is adopted here.

In summary, there is a consistent picture across sectors of changes in household composition acting analogously to changes in total outlay, at least as a first approximation. Additional adults require additional outlay to restore expenditure patterns, but less than the average adult; similarly, and more strongly, for additional children. The presence of extra family members, whether adults or children, with income compensation to keep per capita expenditure constant, results in a rise in the shares of luxury goods such as clothing, durables and recreational expenditures, and a fall in the shares of necessities such as food, housing and fuel.

The patterns associated with the demographic variables presented in Table 3.6 for the Sri Lanka 1980-81 survey are generally consistent with those of the earlier Sri Lankan survey. Again, an extra adult, with per capita expenditure held constant, decreases the shares of necessities - food (in all but the estate sector), fuel, and housing (in all but the urban sector) - while increasing the shares of clothing and recreation. Looking at the effects of an additional child, we see a similar pattern: an extra child, at

constant per capita expenditure, increases the shares of clothing, recreation, and household goods (in all but the estate sector), while decreasing the shares of fuel and housing in all sectors. Note that in 1980 an additional child depresses the food share in only the urban sector. That a rural household in 1970 reallocates away from food upon the addition of a child to the household, while a rural household in 1980 reallocates toward food, reflects both the change in real income between 1970 and 1980 and the change in the government's rice rationing program.

Upon scrutiny, most of the demographic coefficients reflect a decline in standard of living in all three sectors over the decade; while the shares of necessities continue to fall in 1980 when an extra adult enters the household, they do not fall as markedly as they did in 1970, nor do the shares of luxuries rise as far. For example, in the urban sector in 1970 an extra adult, bringing with him or her additional expenditure, decreased the food share by 0.6 percentage points, and by 1980 the corresponding figure was only 0.38 percentage points. The share of recreation in 1970 increased 0.38 percentage points upon the addition of an adult at constant PCE; in 1980 the figure was 0.17 points. This is representative of differences seen in all three sectors. Finally, note that when either an extra adult or child enters the household (at constant PCE), reallocation toward transport, insignificant in 1970, becomes important in the 1980-81 results. This is consistent with the change in the role of transport discussed earlier.

TABLE 3.6: **Quadratic Regressions with Minimal Demographic Effects (zero observations included): Sri Lanka 1980-81**

	Urban						Rural					
	PCE*	Na	Nc	R^2	F-test	e	PCE*	Na	Nc	R^2	F-test	e
Food	-14.99	-0.38	-0.65	.558	36.6	0.78	-9.69	-0.29	0.06	.296	71.8	0.86
Liquor	0.27	-0.18	0.14	.020	4.92	1.07	0.77	-0.10	-0.08	.013	2.25	1.17
Housing	4.09	0.16	-0.60	.241	24.8	1.56	0.65	-0.11	-0.38	.071	33.1	1.16
Fuel	-2.64	-0.27	-0.42	.231	30.3	0.54	-2.09	-0.43	-0.45	.155	138.0	0.67
Clothing	2.09	0.11	0.24	.082	5.15	1.56	1.91	0.23	0.09	.075	15.9	1.48
Household	2.21	0.06	0.29	.123	11.9	1.69	2.04	0.12	0.20	.102	41.5	1.72
Health	1.19	0.05	0.05	.089	6.01	1.45	1.36	-0.01	-0.01	.038	0.17	1.50
Transport	4.84	0.24	0.56	.212	20.0	2.11	3.30	0.29	0.27	.228	157.0	2.09
Recreation	2.54	0.17	0.39	.140	11.1	2.17	1.63	0.29	0.26	.092	58.9	2.17
Communication	0.29	0.03	-0.01	.182	23.2	2.31	0.10	0.02	0.00	.073	29.1	2.28

	Estate					
	PCE*	Na	Nc	R^2	F-test	e
Food	-2.75	0.39	0.66	.124	5.83	0.96
Liquor	1.49	0.25	-0.22	.078	1.86	1.26
Housing	-2.86	-0.59	-0.68	.425	76.9	0.07
Fuel	-2.47	-0.62	-0.47	.197	24.8	0.62
Clothing	2.61	0.05	0.30	.072	2.08	1.58
Household	0.26	-0.01	-0.01	.074	3.67	1.12
Health	0.77	0.15	0.09	.091	1.41	1.40
Transport	1.64	0.15	0.12	.136	6.50	2.00
Recreation	1.13	0.23	0.20	.070	6.02	2.32
Communication	0.06	0.01	0.01	.116	24.1	2.06

* The figures shown represent the joint effect of the linear and quadratic ln(PCE) terms: $B_{1i} + 2B_{2i}(\ln PCE)$.

Source: Sri Lanka Socioeconomic Survey, 1980-81.

Table 3.7 reveals that the broad picture for Sri Lanka also applies to the Indonesian figures. Both adults and children have negative impacts on the shares of fuel, housing (except in urban Java, where an extra adult has a positive impact), and food (except in rural Java, where an extra child has the opposite effect). As in Sri Lanka, both adults and children bringing their own PCE raise the shares of household goods, which include education and health expenditures, transport, and clothing (with the exception of urban Java, where an additional adult lowers this share). The demographic coefficients reflect the income disparities between sectors in Indonesia. For example, an additional adult in the wealthiest sector, urban Java, would decrease the food share 0.95 percentage points, while that adult in the poorest sector, the rural Outer Islands, would decrease the share only 0.65 percentage points.

TABLE 3.7: **Quadratic Regression with Minimal Demographic Effects (zero observations included) Indonesia 1978**

	Urban Java						Rural Java					
	PCE*	Na	Nc	R^2	F-test	e	PCE*	Na	Nc	R^2	F-test	e
Food	-12.21	-0.95	-0.06	.417	9.72	0.79	-8.99	-0.69	-0.11	.149	10.7	0.87
Liquor	0.12	-0.01	-0.00	.005	0.61	2.19	0.21	-0.01	0.03	.018	3.66	5.12
Housing	6.53	-0.21	-0.11	.269	51.2	1.53	0.31	-0.22	-0.47	.114	67.8	1.04
Tobacco	-0.52	-0.25	-0.00	.030	10.8	0.90	1.40	0.15	-0.10	.025	2.19	1.28
Housing	6.97	0.33	-0.02	.182	1.73	1.49	2.22	-0.10	-0.02	.049	0.73	1.62
Fuel	-2.03	-0.18	-0.50	.262	29.5	0.64	-3.80	-0.50	-0.99	.143	34.9	0.59
Household	2.49	0.94	0.16	.157	30.2	1.32	3.16	0.62	0.33	.088	21.0	1.89
Transport	2.80	0.22	0.35	.149	5.62	1.89	1.22	0.14	0.06	.049	5.07	2.94
Clothing	1.56	-0.15	0.11	.044	1.68	1.36	4.09	0.23	0.65	.091	8.84	1.78
User Taxes	0.91	-0.05	-0.03	.081	4.00	1.57	0.50	0.16	-0.06	.021	7.70	1.39

	Urban Outer Islands						Rural Outer Islands					
	PCE*	Na	Nc	R^2	F-test	e	PCE*	Na	Nc	R^2	F-test	e
Food	-10.92	-0.44	-0.58	.221	9.88	0.84	-5.64	-0.65	-0.12	.078	5.83	0.93
Liquor	0.14	0.01	0.06	.014	6.68	2.43	0.34	0.01	0.02	.026	11.9	2.48
Tobacco	0.67	-0.26	0.02	.032	15.0	1.11	1.17	0.02	-0.02	.019	23.9	1.21
Housing	2.84	-0.18	-0.46	.064	6.17	1.28	0.09	-0.03	-0.04	.016	10.5	1.02
Fuel	-0.62	-0.03	-0.19	.017	6.38	0.86	-0.94	-0.35	-0.68	.051	26.9	0.74
Household	3.80	0.62	0.60	.149	53.4	1.74	1.48	0.66	0.30	.085	45.9	1.54
Transport	1.61	0.16	0.10	.116	37.0	2.77	0.21	0.14	0.12	.007	1.77	1.83
Clothing	1.85	0.03	0.25	.039	4.42	1.43	2.53	0.10	0.40	.041	3.20	1.48
User Taxes	0.63	0.09	0.18	.037	15.0	1.68	0.76	0.10	0.01	.016	1.90	1.58

* The figures shown represent the joint effect of the linear and quadratic ln(PCE) terms: $B_{1i} + 2B_{2i}(\ln PCE)$.
Source: SUSENAS 1978

Notes for Further Reading

The material of this chapter is the traditional subject matter of the "analysis of family budgets"; the standard reference remains the book by Prais and Houthakker (1955). One contribution of that study was to provide a list of functional forms for Engel curves. These have been widely applied to a large number of data sets from around the world, see Brown and Deaton (1972) for a general survey, and Bhattacharyya (1978) for numerous studies for India. The functional form used in this chapter originates with Holbrook Working (1943) and so predates Prais and Houthakker, but was not included in their lists, and so was accorded relatively little attention, at least until recently, although see Leser (1963, 1976). Yet the Working form satisfies the adding-up restriction, unlike most of Prais and Houthakker's forms, and is consistent with the observed nonlinearity in the regression of food expenditure on total expenditure. It also belongs to a class of utility consistent models with extremely convenient aggregation properties, see Deaton and Muellbauer (1980) for a more detailed discussion. The survey paper by Deaton (1985a) also discusses these matters as well as some of the developments in Engel curve theory in the last few years.

There are a number of important econometric issues not discussed above. Most household surveys are stratified, so that while each household can be regarded as representative of some large number of households in the population as a whole, the ratios of population to sample households, or "weights" or sometimes "inflation factors", vary across households. It is agreed by everyone that when using such data to calculate means, weights should be applied to each household, so that the sample mean is a consistent estimate of the population mean, even if the strata are non-homogeneous.

There is much less agreement about the appropriate procedures to be used when computing a regression. Standard econometric texts either ignore the issue, or recommend that no weighting be applied, see for example, Klein (1953), Cramer (1969), or Madalla (1983). The argument is that if the strata are homogeneous, there is no need to weight and, indeed, weighting will only decrease the efficiency of the estimation. If the strata are not homogeneous, the pooled regression does not correspond to any well-defined model, so that once again, weighting is not the issue. However, it is often difficult to be sure that all the strata are homogeneous, so that weighting will at least guarantee that the estimates have limits that are independent of the details of the stratification scheme, at the price of some efficiency cost when there is homogeneity. A useful discussion is given by DuMouchel and Duncan (1983) who point out that the weighted regression estimates are consistent for the parameters that would be obtained from the population regression. (Note that it is not clear why this latter should be of interest.)

A second, largely unresolved, issue is how to estimate Engel curves in the presence of zero expenditures. Zero expenditures are not the same as other recorded values, if only because they occur much more frequently than any other single value. Expenditures are also inherently non-negative, so that zero is not just one more point between minus and plus infinity. The standard econometric procedure for zeros was suggested by Tobin in 1958, and is known as Tobin's probit, or (after the Apocryphal prophet) Tobit. This is a statistical model of censoring, whereby potentially negative values are set to zero. However, there are problems with the Tobin procedure. Firstly, with many goods, it is difficult to give a firm theoretical basis to the model; see for example the discussions in Deaton (1981, 1985), and in Lee and Pitt

(1986). Secondly, it is necessary to model explicitly the fact that zero purchases appear for more than one reason; the household may never purchase the good at all, or the household may not purchase the good during the recall period of the survey. In principle, it is possible to construct models that take account of all of this, but they are much too complicated to be estimated even with very high speed computers. Deaton and Irish (1984) provide some initial and not very successful attempts using a British household survey. There are also a set of econometric results for somewhat similar models which suggest that ordinary least squares regression may provide consistent estimates up to a scale factor, see in particular, Greene (1981), Ruud (1983, 1984), Chung and Goldberger (1984), and Stoker (1984). This is an area where there are likely to be major developments in the near future. The results for the Sri Lankan 1969-70 survey are based on the fuller treatment in Deaton (1981, Essay 1). Similar and more extensive results are given for the 1980-81 survey in Thomas (1985).

CHAPTER IV

MEASURING THE COSTS OF CHILDREN

General Considerations

It is generally accepted that children impose economic costs on their parents, but there is little general agreement as to how these costs should be defined or measured. Nevertheless, the issue can hardly be avoided since some measure of child costs is central to any attempt to make welfare comparisons between households of different demographic compositions. As a first approximation, it might be acceptable to count all adults equally, ignoring any potential economies from sharing in larger households, but it is clearly unreasonable to count children as having the same needs as adults. The precise weighting scheme that is used is of more than academic interest, and is likely to make a significant difference to a number of central policy questions. Much economic policy in developing countries is concerned with improving the lot of the poorest members of society, so that the identification of the poor is of great importance.

Because individuals belong to households, and we typically have no or few data on allocation within the household, the best that can be done is usually the identification of poor households. Even if we can agree that total expenditure is a reasonable approximation to individual welfare, then we still must account for the variation in demographic composition between households in moving from household expenditure to some measure of the welfare of the individuals in it. Now, for most countries, total household expenditure is positively, but less than proportionately related to household

size. In consequence, use of total household expenditure as a measure of welfare automatically ensures that small households will be over-represented among the poor, while using per capita household expenditure will guarantee that large households are typically poor households. To actually discover something about the relationship between family size and poverty, as opposed to assuming a relationship, it is necessary to have some procedure for defining and measuring the costs of different family sizes, and particularly the costs of children.

One standard and widely used procedure is to define children, and sometimes women, as fractions of a male adult according to their nutritional needs. Various measures of nutritional requirements are available, but the World Health Organisation (WHO) minimum calorie requirements are probably the most frequently used. Hence, if a five-year old child "requires" 60 percent of the calories required by his/her father, and his/her mother "requires" 90 percent of the same amount, then a household consisting of those three persons would be counted as having 2.5 equivalent male adults. Welfare could then be measured on a comparable basis across households by calculating total expenditure per equivalent male adult for each. There is no doubt that this procedure is a good deal better than doing nothing, and probably at least as good as comparing households in terms of per capita household expenditure, but it is unclear that it is correct, or even approximately so. Firstly, individuals do not consume only food, even in the poorest of countries, and the calorie based scales do not take into account requirements for other types of consumption. Of course, if we are only concerned with the poorest of households, this objection has less force, since food consumption accounts for 70-80 percent of the budget among these groups. Secondly, however, it is very

unclear that the calorie requirements are even relevant to the welfare of the individuals we are considering. There has been a great deal of dispute as to whether the WHO or other figures accurately do measure, or even can in principle measure, true calorie needs. But even this is not the central objection, which is that it is quite incorrect to equate welfare with nutritional status. While adequate nutrition is undoubtedly an important component of welfare, particularly when incomes are inadequate to ensure proper nutrition, it makes no sense to claim that it is all of welfare. Furthermore, the empirical evidence on consumption patterns shows convincingly that consumers have little respect for nutritional norms, frequently purchasing so-called luxuries when so-called "basic" needs have not been met. It seems to us that there is an overwhelming case for accepting consumers' own evaluations of their needs and preferences, and that the case is no less strong for very poor undernourished consumers in Sri Lanka or Indonesia, than it is for materially well-provided individuals in North America or Western Europe. If so, then the appropriate place to look for a measure of child costs is in the behavior of households of different demographic composition, as revealed, for example, in the sort of empirical evidence discussed above in Chapter III.

A large number of procedures exist for using empirical evidence on behavior to generate estimates of the costs of children. Some of these are fairly complex, and can require sophisticated and difficult estimation and computation, see Deaton and Muellbauer (1980, 1986) for discussion of some of the details. However, we do not believe that very much is lost by keeping to the simpler procedures. To early investigators, the problem seemed very straightforward, and it is worth reviewing their ideas briefly, since the

issues are still very much alive. We all have an intuitive notion of what sort of costs are associated with the presence of children, so the first thought is that examination of household budgets ought to lead to their identification, with total child costs simply being estimated by addition of the appropriate amounts. For instance, in their classic study of the "money value of a man", Dublin and Lotka (1930), net out the "input" costs, that is, the costs of bringing the individual to economic maturity. They begin, appropriately enough, with "the cost of being born", add on educational costs, and make allowances for goods that are not child-specific by pro-rating typical household budgets.

Unfortunately, things are not this simple, and such an attempt is not likely to be successful in this form. The problem is that the increase in educational expenditure or whatever is associated with the extra child must be offset somewhere else in the budget, unless the child is fortunate enough to bring with it an increase in household resources. Hence, if we could identify <u>all</u> of the changes in the budget that follow from the arrival of an additional child (this is what the regression analysis in Chapter III tries to do), and if we then added up all such changes, we should find that the "net" figure is exactly zero. What is needed is some procedure for picking out those changes in expenditures that are indeed extra costs associated with the child, and excluding those changes that reflect the sacrifices made by the adults to accommodate the new expenditures. All of the modern methodologies for measuring child costs do exactly this either explicitly or implicitly. Unfortunately the assumptions are more often implicit than explicit, and different procedures make different assumptions, so that they can yield quite different answers, even using the same empirical evidence.

Engel's Procedure

Amongst the methods that use behavior to calculate child costs, by far the most popular is the procedure originally pioneered by Engel more than a century ago. In his empirical work, Engel noted that, amongst households of similar demographic composition, the budget share devoted to food declined with the amount of the total budget, a proposition that has become enshrined as Engel's Law. The empirical results in Chapters II and III, like virtually all of those from household budgets, are broadly consistent with Engel's original finding. Engel also noticed that among households with the same total expenditure, but with differing size, the food share was highest for those with the largest family size, so that additional individuals at the same income had much the same effect as decreases in income. This finding too is consistent with most of the empirical evidence in this study, and with most from elsewhere. However, Engel went further than the two empirical laws, and put forward a proposition that, while consistent with the evidence, does not follow from it. The proposition is that households with the same food share have the same level of welfare independent of their demographic composition. If this is true, we can resolve the problem of adding up the changes in expenditures due to children and getting zero. For if we can find two households that spend identical fractions of their budgets on food, one without a child and one with, then the larger household will have the larger total expenditure, and the difference is precisely the extra amount needed to compensate for the economic costs of the child. Comparison of the detailed budgets of the two households will show how this additional expenditure is allocated, so that the food, educational, and other costs of the child can be

identified. In practice, "typical" households from regression analysis are used rather than individual actual households, but the principle remains the same. The method also has the great advantage of simplicity. Given an Engel curve with total expenditure and family size as arguments, the compensations for additional children require only trivial calculation, or can be read off from a simple graph.

It is very easy to see the broad outlines of what will happen if Engel's method is applied to the results in Chapters II and III for the Sri Lankan and Indonesian surveys. For all three surveys, an excellent approximation to the effects of demographics on the food-share is given by including per capita total expenditure as an explanatory variable. In consequence, to the same degree of approximation, two households will have the same food share if they have the same level of per capita total expenditure, no matter how different their compositions. Since food share means welfare according to Engel, this means that households are compensated for additional children by keeping their per capita outlay constant, so that, to a first approximation, children cost the same as adults. In fact, if the additional demographic terms in the regressions are accounted for, the child costs come out a little lower, but we still estimate that children cost 80-90 percent as much as adults, figures that seem implausibly high.

But there are also theoretical reasons for doubting the validity of Engel's procedure. Note first that Engel's proposition is simply an assertion; while it is consistent with the empirical evidence, it does not follow from it. Furthermore, it is a generally implausible assertion.

Consider the following argument, taken from Nicholson (1976): a household consists of a couple alone, who subsequently have a child. Assume

that the true compensation for the economic costs of the child is known, and that it is paid to the couple immediately on the birth of the child. By assumption, the parents are as well off as they were before the birth of their child, and we can expect them to have a similar consumption pattern. The child's consumption pattern, however, will generally differ from that of its parents, and in particular, we may suppose that the child's consumption pattern will have a greater bias towards food than does that of its parents. On average, therefore, this perfectly compensated household is spending a larger proportion of its outlays on food than it did before the birth of the child. If the household is compensated according to the Engel formula, then it will have to be given more money so that the food share will be driven down to its original level. Such a household would therefore be overcompensated. The amount of money required to keep the food share constant is greater than that required to compensate the household so that the Engel method generally overstates the cost of children. Such a theoretical conclusion is certainly consistent with the evidence given above. On these grounds, we do not recommend the Engel method for computing child costs; while it is simple, it is unlikely to give reliable figures, and, as we shall see, there are other simple methods that make better sense and give more sensible numbers.

Rothbarth's Method

The method we recommend here is a development of the technique first suggested by Erwin Rothbarth in 1943. The basic idea goes back to that of Dublin and Lotka, and relies on being able to define certain "adult" goods that are not directly consumed by children. For these, the presence of additional children will act like a decrease in income, but otherwise have no

effect. Consider a couple who, before they have children, have a little money left over after meeting their basic needs which they spend on a weekly visit to the cinema. The newly arrived child does not go to the cinema, but nevertheless requires food and clothes which are paid for out of the unchanged family budget by reductions in the parents expenditure. The parents now visit the cinema less frequently, they eat rather less well themselves, and they cut down on their own expenditure on clothing, by making garments last longer, and by cutting down on items that are not strictly necessary. These cuts are in response to the need for money to feed and clothe the child; there is no specific relationship between the consumption given up by the parents and the child's own consumption. As a consequence, the changes in parents' consumption are exactly those that would have taken place had there been no child, only a reduction in their income. In this example, we cannot observe this for food or for the clothing aggregate, since the reduction in adult consumption is offset by the new consumption by the child; food and clothing are "mixed" goods. However, cinema attendance is an adult good, and so is adult clothing, if such expenditures are distinguished separately in the data. Therefore, we can identify the reduction in adult expenditures on those two goods, and if we know from Engel curve analysis what are the income elasticities of these goods, then we can calculate what income reduction would have caused the same change in adult expenditure as was caused by the child. This is the Rothbarth estimate of the cost of the child. Even better, it is possible to test behavior for the presence of adult goods, at least partially.

In the above example, since the effect of the demographic change acts only through the equivalent income change, the ratio of the reduction in adult

clothing expenditure to the marginal propensity to consume adult clothing out of income should be the same as the ratio of the reduction in cinema expenditure to the marginal propensity to spend on cinema attendance. For any group of two or more potential adult goods, such a prediction can be tested. Alternatively, it is possible to compute ratios for a whole group of goods, and then to search among them for an empirically satisfactory group of adult goods. Note however that the empirical results cannot tell us everything. It is not possible to test a single good for being an adult good, and in any group of goods, at least one must be selected to be an adult good a priori.

An Empirical Illustration

The details of this procedure will vary from country to country and from survey to survey, depending on local consumption customs and on the data that are available. Here we illustrate for the case where detailed data are available using evidence from a Spanish household survey, and then return to our examples from Sri Lanka and Indonesia. The Spanish results are taken from Deaton, Ruiz-Castillo, and Thomas (1985), where the procedures and the survey are described in much more detail. The Spanish survey (Encuestos de Presupuestos Familiares 1980-81) is particularly appropriate for this work because there are 625 separate items of expenditure so that it is possible to pick out a large number of possible candidates for adult goods. We also select a number of goods that are potential "child" goods, so that, by analogy with the adult goods, it is possible to see whether, for those categories, the presence of additional adults acts like changes in income. Table 4.1 lists the goods that were chosen for inspection, together with their definitions. Note that at this stage, we are not committed to any of these as being either

TABLE 4.1: **Commodity Shares as a Percentage of Total Expenditure and Fractions of Households Purchasing**

	Mean Share	Fraction Purchasing	Symbol
DETAILED COMMODITIES			
A. Mainly Adult Goods			
Adult Clothing and Footwear	6.11	0.898	ACF
Meals and Food Outside the House	3.58	0.752	MOUT
Entertainment and Culture	2.72	0.731	ENTC
Transport	8.39	0.856	TSP
Personal Care	0.55	0.293	PERC
(a) Unclassified Expenditures	1.61	0.601	NES
Tobacco and Smoking Devices	1.34	0.639	TOB
Alcohol Consumed at Home	1.76	0.712	AL
Alcohol Consumed outside Home	1.46	0.611	AOUT
Health	2.27	0.687	HLT
(b) Other Mainly Adult Goods	2.08	0.814	OTHA
B. Mainly Child Goods			
(c) Baby Goods	0.47	0.178	BABY
(d) Regular Children's Goods	2.96	0.616	RCHG
(e) Children's Foods (1)	0.55	0.414	CH1
(f) Children's Foods (2)	1.21	0.712	CH2
Other Foods	34.68	1.000	FFD
(g) Miscellaneous Household Goods	3.66	0.896	CHG
(h) Semi-durable Household Goods	1.16	0.423	SDHG

Notes:

(a) insurance, gambling, funeral expenses, membership dues and subscriptions, licenses, taxes, and transfers to public institutions.

(b) stationery excluding school materials, payments for financial services (commission on exchange transactions), payments for personal services (officials at weddings, funerals).

(c) baby foods, baby clothing, baby furniture, expenditure on day care, and baby carriages and personal care items.

(d) children's clothing, children's footwear, toys, educational expenses, and children's pocket money.

(e) various foods, including prepared foods with a cereal base, powder items containing cocoa, other chocolate products, chewing gum and candy bars.

(f) cookies, croissants, donuts, cakes and pies, jams, honey, syrup, ice cream, cocoa and chocolate, frozen and preserved fruits.

(g) current expenditure items: domestic services, bulbs and electrical items, cleaning products, laundry, toilet paper and other paper products, nails, small accessories.

(h) minor capital account items: dishes, pots and pans, coffee machines, hammers and tools, sheets, blankets, towels and tablecloths.

Source: Deaton, Ruiz-Castillo and Thomas (1985), from Encuestos de Presupuestos Familiares, 1980-81.

adult or child goods, whichever the case may be. We aim to examine these goods as potential adult or child goods, so that once the groups have been built, estimates of costs can be calculated.

The methodology of estimation is exactly the same as that described in Chapter III. For each of the goods, an Engel curve is estimated of the general form

$$w_i = \alpha_i + \beta_{i0}\ln\{PCE\} + \beta_{i1}[\ln\{PCE\}]^2 + \Sigma\gamma_{ij}n_j + u_i \qquad (4.1)$$

The estimated parameters are then used to calculate the effects of changes in composition and of total expenditure. In particular, we calculate for each good the quantity π_{ir} given by:

$$\pi_{ir} = \frac{\gamma_{ir}n-\beta_i}{w_i + \beta_i} = \frac{\partial(p_iq_i)/\partial n_r}{\partial(p_iq_i)/\partial x} \cdot \frac{n}{x} \qquad (4.2)$$

where x is total household expenditure and n is household size. The derivative of the numerator in the last expression in equation (4.2) is the effect of an additional person of type r on the expenditure of good i, while the denominator is the marginal propensity to spend on i out of total expenditure. The ratio is therefore (minus) the change in total expenditure that would have an equivalent effect on the consumption of good i as would an additional person of type r. The π-ratio expresses this change as a fraction of existing <u>per capita</u> income, so that if π_{ir} is -0.5, say, an additional type r person has the same effect on the consumption of i as would a 50 percent reduction in <u>per capita</u> total outlay.

Table 4.2 lists the calculated π-ratios for the goods listed in Table 4.1; since the value of each π will vary from household to household, see equation (4.2), we have presented the ratios evaluated at the sample means of each of the data series. Note also that there are seven different demographic categories in the table. Starting from the lefthand side, the groups are in decreasing order of age; "old" people aged over 60 come first, followed by "regular" adults, aged 24 to 60, young adults aged 18 to 23, "teenagers" aged 14 to 17, "large" children aged 9 to 13, "small" children aged 5 to 8, and "babies" aged 4 and under. Recall that, if a ratio is positive, then the outlay-constant effect of an additional individual of the type on that expenditure is also positive. For true adult goods where the demographic category is a child, the income effect is the only effect, and the ratio must be negative. More generally, negative ratios indicate that income effects dominate any positive direct, or needs-related effect, or that the direct effects of the demographic category are negative for that type of expenditure.

The figures in Table 4.2 show that our preliminary allocation of goods to "adult" and "child" categories has been at least partially successful. For <u>all</u> of the adult goods, the ratios for small and large children are uniformly negative. For the potential child goods, it is clear that food ought to be excluded; for all age groups the ratio is positive. This is what we might expect and hope for; as in the hypothetical example above, food is a good that is shared by all family members, even if it is relatively more important to children. For the other child goods, the ratios for both regular and young adults are negative. The large positive ratios are also where we would expect to find them. Everyone needs food; babies need

TABLE 4.2: **Demographic Effects in Relation to Income Effects on Demand (π_i's)**

	π_0	π_{A2}	π_{A1}	π_4	π_3	π_2	π_1
ACF	-0.2422	-0.1143	0.0303	0.2482	-0.4943	-0.4864	-0.4647
MOUT	-0.0968	0.1806	0.0387	-0.1026	-0.4327	-0.2600	-0.2260
ENTC	-0.2631	0.2288	0.5736	0.5634	-0.3723	-0.3742	-0.6311
TSP	-0.0460	0.1735	-0.0224	-0.3236	-0.2983	-0.1767	-0.1594
PERC	0.0070	0.1041	0.0224	0.0043	-0.4855	-0.2778	-0.2769
NES	-0.2777	-0.1218	0.1146	-0.4421	-0.4357	-0.2115	-0.1679
TOB	0.2383	0.7287	1.4528	0.3945	-0.3398	-0.1035	0.2047
AL	0.0425	0.0589	-0.3022	-0.2940	-0.2376	-0.2150	0.3043
AOUT	0.3890	0.9471	1.1763	-0.0275	-0.4679	-0.1869	-0.1132
HLT	0.0244	-0.1566	-0.2841	-0.2266	-0.9015	-0.1445	0.3874
OTHA	0.0442	0.0555	-0.0198	0.0143	-0.1468	-0.1110	-0.3560
BABY	-0.5723	-0.6664	-0.2751	-0.5726	-0.8613	-2.3379	8.2828
RCHG	-0.1786	-0.1327	-0.7453	-0.5659	2.7853	2.7076	0.3417
CH1	0.0874	-0.0198	-0.0313	0.5676	0.7905	0.7108	1.7395
CH2	0.0241	-0.1377	-0.1065	0.2957	0.5150	0.7096	0.2938
FFD	0.3718	0.2931	0.1078	0.3173	0.4626	0.4180	0.2717
CHG	-0.3718	-0.4701	-0.3673	-0.3294	-0.0926	-0.0155	0.1993
SDHG	-0.6618	-0.6849	-0.2283	-0.3004	-0.2746	-0.2740	-0.2259

Note: See Table 4.1 for key to variable names.
Source: Deaton, Ruiz-Castillo and Thomas (1985), from Encuestos de Presupuestos Familiares, 1980-81.

baby goods, and children child goods. Young adults have strong effects on tobacco, on alcohol consumed outside the home, and on entertainment and culture. Perhaps the most interesting ratios are those for babies on adult goods. As we should expect, most of the figures are negative, but there are three exceptions. That for health is not surprising, but there is also evidence here that the presence of babies is associated with increased expenditure, presumably by the parents, on alcohol (consumed in the home, not outside) and on tobacco. This is an effect that is predicted by Barten's (1964) model of demographic effects; since adult goods do not have to be shared with children, the presence of children makes adult goods cheaper relative to mixed goods. Alcohol outside the home would not of course be rendered cheaper by the presence of children if it is either inconvenient or expensive to leave them at home. (Barten's is of course not the only explanation why the presence of infants causes their parents to smoke and drink more!) As far as we are aware, it is also an effect that typically does not show up in the data, see for example Atkinson and Stern (1981) for the United Kingdom and the results above in Chapter III.

Returning to the negative ratios in the Table 4.2, the possibilities of constructing groups of adult and child goods do not look unpromising. Looking at the π_3 column for adult goods, the average is between -0.3 and -0.4 with health as a negative outlier (large children depress health expenditures more than would be expected by what appears to be their income effect), and with the other category as a positive outlier (conversely). The same can be said, pari passu, for the next two columns as well as for the π_{A2} and π_{A1} columns in the adult good section of the table. Deaton, Ruiz-Castillo, and Thomas go on to discuss statistical procedures that use these

figures to construct a group of adult goods to be the basis for a measure of child costs. Various combinations of goods are considered, but once a group has been defined, costs are calculated by running a regression of the form (4.1) for the group as a whole, and then calculating the reduction in total expenditure that would decrease total adult good expenditure by as much as an uncompensated increase in family size. This can be done for each of the child groups in Table 4.2, and it was found that, depending on the precise definition of the group of adult goods, large children were estimated to cost about one third of an adult, with small children and babies costing about one quarter. We feel that these figures are much more reasonable than the very large estimates yielded by the Engel model.

Table 4.3 presents the comparable calculations for the three surveys discussed in the earlier chapters. Since we do not currently have the same amount of detail for these surveys as for the Spanish one, the π-ratios are calculated for the broad groups only. Such groups are of course less likely to be "pure" adult or child goods. We have also for these surveys re-estimated the regressions separately for each quartile of per capita expenditure. This is somewhat more successful for the Sri Lankan surveys than for the Indonesian one where the Engel curves tend to be unstable across quartiles. The procedure is designed to pick up possible differences in child costs between households of different standards of living.

TABLE 4.3: **Income Equivalents of an Additional Child Relative to Per Capita Expenditure**

	Sri Lanka 1969-70	Sri Lanka 1980-81	Indonesia 1978
Food	0.2281	0.1702	0.1117
Alcohol	-0.1731	-0.1830	0.1189
Tobacco			-0.2265
Housing	-0.4944	-0.5773	-0.3482
Fuel	-0.0572	-0.3310	-0.0379
Clothing	-0.1849	-0.2144	-0.1389
Transport	-0.3085	-0.2732	-0.3374
Communication		-0.5394	
Household Goods	0.2008	-0.2795	-0.1723
Recreational	-0.1349	-0.0994	--
Medical	-0.2140	-0.2852	--
User Taxes	--	--	-0.1974
Total Non-Food	-0.2353	-0.2513	-0.2000

Source: Sri Lanka Socioeconomic Surveys, 1969-70, 1980-81; SUSENAS 1978.

For the Sri Lankan surveys, the π-ratios are negative except for food, and for two of the quartiles, for fuel. Hence, additional children act as would income reductions except for those two goods. The Indonesian story is similar, though like the Indonesian results in general, the figures are more erratic and there are a few other positive figures scattered through the table. Without the commodity detail, we cannot experiment with alternative definitions of adult goods as we could for Spain. However, transport, alcohol and tobacco, and clothing are possible categories where the child component is likely to be relatively small. The π-ratios for these categories would suggest an overall average of a quarter to a third, figures that would translate into a cost per child relative to an adult of 15-20 percent, that is, somewhat less than the Spanish estimates.

While we find it plausible that the cost of a child relative to an adult should increase with the level of development, we would not wish to place too much weight on these figures. We believe that the procedures used in this chapter are sensible, and we believe that they can usefully and insightfully be applied elsewhere. However, in the current state of knowledge, not to say controversy, on these matters, it is better to think of these methods as yielding orders of magnitudes rather than precise numbers. The results from the various surveys analyzed here show that adults cut their own expenditures in response to additional children in the household by an amount that is consistent with a belief that that children bring additional needs that are between a third and a sixth of those associated with a typical adult. Note that this finding, if widely accepted, would imply that identifying poor people on the basis of household <u>per capita</u> expenditure would tend to exaggerate the poverty of households that have many children.

Notes for Further Reading

The various procedures for using behavioral evidence as the basis for estimating child costs are reviewed in Chapter 8 of Deaton and Muellbauer (1980), see also Pollak and Wales (1982). Apart from the Engel and Rothbarth procedures that are discussed in this chapter, the most important of the models are those due to Prais and Houthakker (1955), originally suggested by Sydenstricker and King (1921), Barten (1964), and Gorman (1976). The Prais-Houthakker formulation involves a concept of commodity specific adult equivalents, so that the demand per commodity-specific adult of each good is linked to the overall resources of the household. Barten's model draws an elegant analogy between the effects of household composition and the effects of prices, and so emphasizes the price-like consequences of changes in household composition. Gorman's model is an extension of Barten's in which additional individuals bring with them certain fixed costs, as well as altering "effective" prices in the way suggested by Barten. The Gorman model is perhaps the one that makes the most theoretical sense, but without making very special assumptions, both it and the Barten model are complex and expensive to estimate. Deaton and Muellbauer (1986) show what sort of biases are involved in using the Rothbarth and Engel procedures when, in fact, the Gorman model is true. In general, the Engel method is likely to give estimates that are too small, though the error here is likely to be less severe.

The Spanish results quoted above are a small part of an extensive study of demographics on consumption patterns with special reference to the restrictions implied by the Rothbarth model, see Deaton, Ruiz-Castillo, and Thomas (1985).

We should note finally that there is a school of thought, particularly Pollak and Wales (1979) which argues that it is impossible to infer the costs of children from household budget data. In a sense, this is true, but no more so than the general proposition that untestable identifying assumptions are always required before any parameters can be estimated in any statistical procedure. However, it is certainly the case that much of the work on measuring child costs has left the identifying assumption uncomfortably implicit. Different authors have reached different results, not because their data sets or results were different, but because their identifying assumptions were different. For example, the Engel measure of child costs is not an estimate of the same thing as is the Rothbarth estimate, and it is necessary to decide in advance whether the food share or expenditure on adult goods is a sensible indicator of adult welfare. We prefer the latter, and see no grounds for the former. These issues are discussed at greater length in Deaton and Muellbauer (1986).

The use of nutritional norms, and of the WHO norms in particular, is discussed by a large number of authors; useful references which contain further bibliographies are Sukhatme (1977, 1978), Srinivasen (1981), and Sen (1984). Lipton (1983a and 1983b) discusses the use of calorie based schemes for the identification of the poor.

CHAPTER V

PRICES AND WELFARE

The prices that consumers pay are the link between their incomes and their welfare. For producers, market prices also play a role in determining their incomes. Although household surveys collect only limited information on prices themselves, survey data on consumption and production provide much of the information for assessing the link between prices and welfare. Price indices of the cost-of-living typically use weights from household expenditure surveys, and the disaggregated data from the surveys allow the construction of different price indices for different types of households whether distinguished by occupation, by income, by region, or by demographic composition. Some of the possibilities are illustrated in this chapter. Household surveys also provide the basis for an analysis of the effects of prospective price changes, particularly those arising out of changes in tax or subsidy policies. Consumption and production data tell us who will benefit and who will lose under various possible policy changes. They also provide part of the information necessary for the design of fiscal reform. An introduction to this kind of analysis is provided below.

Aggregate Price Indices

Economic theory tells us that to obtain a cost-of-living index comparing one set of prices with another, we must compare the relative costs of reaching the same welfare level at the two sets of prices. Because price

differences are typically associated with changes in welfare, one of the costs involved in the comparison is necessarily a hypothetical one, the calculation of which requires assumptions about behavior that cannot be checked on cross-section survey data. However, there are a number of approximations that, in specific circumstances, are likely to be adequate. The usual formulae, for comparisons across time, is the Laspeyres price index defined by:

$$P_L = \sum_i q_i^0 p_i^1 / \sum_i q_i^0 p_i^0 \qquad (5.1)$$

where p_i^0 and p_i^1 are the prices of good i in periods 0 and 1 and q_i^0 are the quantities purchased in the base period. For current purposes, it is more convenient to rewrite (5.1) in the form:

$$P_L = \sum_i w_i^0 \left(\frac{p_i^1}{p_i^0}\right) \qquad (5.2)$$

so that the index is the weighted sum of price relatives, the weights consisting of the budget shares in the base period.

Depending on the structure of the survey, the Laspeyres formula (5.2) can be used in a number of ways. Price relatives are typically not collected as part of the household survey effort. They are collected periodically in shops and markets rather than in households, and then weighted together using weights from the most recent available household surveys. In countries where

surveys are frequent, it is possible to smooth the weights by using moving averages of shares over several years. Usually this is not an option and indeed, a typical reason for holding a new household survey is that the weights for the price index are out of date and no longer truly reflect current spending patterns. It is also important to be aware of the strengths and the weaknesses of the Laspeyres formula. On the positive side are its ease of calculation, its relatively close approximation to the "true" cost-of-living index number over time, and the possibilities for disaggregation (see below). On the negative side is the fact that the Laspeyres index takes no account of substitution in response to changes in relative prices, so that the welfare losses associated with increases in prices tend to be exaggerated. Over relatively short time periods, this is probably not very serious, but for longer periods or for comparisons between different countries or regions, where long-established price differences are related to long-established differences in consumption patterns, the omission is important and greatly diminishes the usefulness of the index. Note also that over short time periods, there are no serious practical problems in measuring the price relatives (p_i^1/p_i^0); even if the identical commodity cannot be identified, a close substitute can usually be found. Over longer periods difficulties become more severe while, over space, insuperable difficulties can often arise; even within a country, many commodities are available only in specific locations. For example, "fish" at the coast may be a cheap staple while "fish" further inland may be a rarely encountered delicacy; it is far from clear that comparing prices per kilo of a fish (however identified) makes any sense at all.

As written, the Laspeyres index (5.2) applies to a single household, although in practice it is invariably used for some group, often for all households in the economy. A simple average of the Laspeyres indices for each household is an appropriate method of aggregating. From (5.2), this is what will automatically be calculated if the average budget shares are applied to the price relatives (which are, of course, the same for all households). But frequently Laspeyres indices are not calculated in this way. Instead, the weights are calculated by dividing society's total expenditure on each good by the total over all groups. As discussed at the beginning of Chapter II, such weights are biased towards the expenditure patterns of better-off consumers, so that their use in a price index also biases the price index to give greater representation to such households. Prais (1958-9) has called such indices "plutocratic" price indices and those based on simple averaging (which are recommended here) "democratic" price indices. Unlike national income data, containing only aggregate expenditures, household survey data permit construction of the democratic index.

Disaggregated Price Indices

The Laspeyres formula (5.2) can be applied to any group of individuals, disaggregated by any criterion. One of the most obvious is to separate rich from poor consumers since their consumption patterns tend to be different. In particular, if the relative price of food to manufactured goods changes, price indices are likely to be quite different for rich versus poor consumers. For illustration, refer to Table 2.6 showing the distribution of consumption by deciles in Sri Lanka in 1969-70. Suppose that, over a ten-year

period, the price of food rises three times, that of fuel five times, those of transport and durables remain constant, and that of all other goods doubles.

TABLE 5.1: **Price Indices by Decile for Hypothetical Price Change: Sri Lanka, 1969-70**

Decile	1	2	3	4	5	6	7	8	9	10	All
Price	2.86	2.82	2.81	2.78	2.77	2.73	2.69	2.66	2.57	2.48	2.72

Source: Sri Lanka Socioeconomic Survey, 1969-70.

The Laspeyres indices for this hypothetical example are given in Table 5.1. The poorest decile has a price index that has risen 5 percent more than average, while, for the top decile, prices have risen 9 percent less than average. Of course, the relative position could have been reversed, with price rises favoring the poor relatively; this would have happened if the price of food had risen by less than average.

Such calculations can be repeated for other income classifications, for occupations (though see below for the effects of price changes on producers), or for disaggregations of households based on demographic composition. However, the procedure can be mechanised and simplified if Engel curves taking account of socioeconomic factors have been estimated. The functional forms suggested in Chapter III are particularly convenient in this regard. Start from the simplest case, equation (3.2), that is:

$$w_i = \alpha_i + \beta_i \ln PCE, \qquad (5.3)$$

and rewrite as:

$$w_i = \alpha_i^* + \beta_i \{\ln PCE - \ln \overline{PCE}\} \qquad (5.4)$$

where $\overline{PCE}$ is mean per capita household expenditure and α_i^* is $\alpha_i + \beta_i \ln \overline{PCE}$. In (5.4), α_i^* is the budget share of good i predicted for a household with average PCE. This formula can then be substituted for the weight in the Laspeyres formula (5.2), so that

$$P_L = \Sigma \alpha_i^* \left(\frac{p_i^1}{p_i^0}\right) + \Sigma \beta_i \frac{p_i^1}{p_i^0} \{\ln PCE - \ln \overline{PCE}\} \qquad (5.5)$$

$$= P_L^a + P_L^m \{\ln PCE - \ln \overline{PCE}\}. \qquad (5.6)$$

The quantities P_L^a and P_L^m are referred to as average and marginal price indices respectively, see Muellbauer (1978) who first suggested this approach; they are defined by the comparison of (5.5) and (5.6). The average index P_L^a is a Laspeyres price index in its own right; it uses the weights for a household at average PCE and will correspond closely to the single Laspeyres index for the society as a whole. The marginal index P_L^m tells us how changes in PCE affect the cost-of-living. Note that β_i coefficients in (5.4) sum to zero since they represent the rearrangement of the budget as total outlay changes. P_L^m is therefore an index whose weights sum to zero, with luxuries having a positive weight, and necessities a negative weight. Hence, if the price relatives are such that necessities have become more expensive relative to luxuries (as in the above example), the marginal index will be negative, and visa versa.

Hence, by employing two sets of weights (the α's and β's), the Engel curve approach allows any set of price relatives to be used to calculate both the average Laspeyres index and the distributional impact of the price changes as summarized in the marginal index. Price changes that give a negative value to P_L^m can be thought of as "anti-poor", and those with P_L^m positive as "anti-rich".

In Chapter III, the basic Engel curve specification (5.3) was compositions, see equation (3.6). Since the numbers of individuals in each demographic class enter the equation linearly, the approach used above can also be used to obtain the impact on the Laspeyres index of additional household members of any particular type. For example, if γ_{ir} is the coefficient linking an individual of type r in the household to the budget share of good i, then if PCE is held constant, the effect on the Laspeyres index of replacing an individual of type r by one of type s, is given by

$$\Delta P_L = \sum_i \{\gamma_{is} - \gamma_{ir}\} \left(\frac{p_i^1}{p_i^0}\right) \qquad (5.7)$$

Prices, Profits, and Consumer Surplus

For some purposes, particularly for the design of government policy, price indices are clumsy tools since they look at the general consequences of all price changes. For policies that involve consequential price changes (taxation and benefit policies, food policy, transport pricing policy, public projects, and so on), direct assessment of the welfare consequences is required. The appropriate tools here are those of consumer and producer surplus. Like index numbers, to which they are closely related, and special

cases apart, consumer and producer surplus measures cannot be evaluated accurately from household survey data alone. However, there is much that is relevant in the survey data, certainly enough to make household surveys an invaluable aid to policy making. In this section, we review some of the concepts and look at some examples.

Rather than measure the welfare consequences of price changes by index numbers, it is possible to do so by discovering the amount of money necessary to compensate the individual. When quantities do not change by much, or for small price changes, Δp_i say, this is straightforward; compensation is given by:

$$C = \sum_i q_i \Delta p_i \qquad (5.8)$$

It is important to realize that this formula works for producers or producer/consumers as well as for pure consumers. Since q_i is consumption of good i, production, as negative consumption, must be measured negatively. This makes sense; if a small farmer is a net producer of rice, an increase in the price of rice makes him better-off, so that his required compensation is negative. In general, the q_i's in (5.8) are net consumptions, positive if the unit is a net consumer, and negative if it is a net producer.

The formula (5.8), together with consumption and production data from a household survey, is in itself a valuable guide to policy. To take a concrete example, Thailand has a complicated set of policies governing the sale and distribution of rice, an important element of which is an export tax which keeps the domestic price of rice well below the world price (about 25

percent below in 1977). An increase in the price of rice might therefore be thought to be desirable on efficiency grounds; production is likely to be stimulated and consumers deterred from "inefficient" consumption. It could also be argued that the price increase will improve distribution by redistributing real income from urban areas to rural areas where incomes tend to be lower. These questions can be settled by reference to a household survey, in this case the 1975/76 Socioeconomic Survey. In the urban areas, consumers are net consumers of rice and spend between 7 and 9 percent of their total expenditure, or about 20 percent of total food expenditure, on rice. Clearly urban consumers will be worse-off as a result of the price change; those who have the highest budget shares will be the worst affected in proportion to their resources. Since rice is a necessity, budget shares of the poor are higher than those of better-off consumers so that any price rise will worsen the distribution of real income within the urban areas. Turning to the rural areas, the impact of any price depends on the position of the household. Those that are not paddy farmers are in the same position as urban consumers, they are hurt by the change and since they typically spend more of their budget on rice (18-20 percent), their position would be worsened even relative to urban consumers. But even among paddy farmers, it turns out that only relatively large land-owners will benefit by much. Table 5.2, taken from Trairatvorakul (1984) shows the percentage of paddy-farming households that are net producers of paddy in relation to farm size.

TABLE 5.2: **Farm-Size and Proportion of Net Producers Paddy-Farmers: Thailand 1975-76**

Size (rai)	% of Net Producers	% of Sample	Size	% of Net Producers	% Of Sample
2	18.2	0.5	30-39	89.4	10.6
2-4	44.2	7.8	40-49	95.9	5.0
5-9	66.2	18.6	50-69	94.3	6.3
10-14	75.6	17.6	70	94.8	3.9
15-19	80.7	10.9			
20-29	85.0	15.8	Total	7.77	(100)

Source: Trairatvorakul, 1984.

Such partial evidence tends to suggest that an increase in the price of rice is not likely to be justifiable on distributional grounds alone. Of course, a full evaluation requires other evidence, particularly on supply and demand responses to a sizeable price change, as well as on likely changes in the rural wage in response to the increase in the price of paddy.

In cases where the price change is large, or when the quantities are very sensitive to price changes, equation (5.8) is unlikely to be a good approximation to the amount of money required to compensate an individual for a price change. The problem is that individuals will change their behavior in response to the change in prices, so that giving them enough money to restore their original consumption pattern will generally be over-sufficient. A better approximation to the true compensation is provided by:

$$CV = \Sigma\, q_i^0(p_i^1 - p_i^0) = \tfrac{1}{2}\, \Sigma\Sigma\, (p_i^1 - p_i^0)s_{ij}(p_j^1 - p_j^0) \qquad (5.9)$$

where s_{ij} is the substitution effect of an increase in the jth price on the demand for good i. Clearly, household survey analysis cannot help us measure these quantities - unless the survey contains genuine regional price variation - but if only a single price change is being considered, only one price response is required, and it is often possible to make a reasonable estimate using off-survey evidence. However, there are alternative approximations that do not require estimates of price elasticities and that may nevertheless work well in practice. One useful approach is to specify compensation as a fraction of original resources rather than as a sum of money; this is more akin to the index number approach. Define CT, the Tornqvist approximation to the compensation, by the formula:

$$\log\{1 + CT/x^0\} = \Sigma\bar{w}_i(\log p_i^1 - \log p_i^0) \qquad (5.10)$$

where the w with overbar indicates that the share is the average of the shares in period 0 and period 1. To interpret this, note that the righthand side is a weighted average of percentage price changes, where each price change is weighted according to the importance of the corresponding good in the budget. The expression is therefore interpretable as the percentage change in the cost of living. Theleft hand side is approximately CT/x, so that CT is the fraction of original resources required to make the compensation. The formal properties of CT are fully discussed by Diewert (1981). The measure gives an exactly correct measure of compensation under quite general

circumstances, and it requires only limited information. Note, however, that the calculation does require some estimate of the effects of the policy, since the demand pattern after the policy change enters into the formula. However, reasonable conjectures are probably not too hard to come by; for example, Thai policy makers could almost certainly give a good estimate of the effects of a 10 percent increase in the price of rice on the share of rice expenditure in urban budgets. Hence the measure CT seems a reasonable compromise between theoretical accuracy and what can be done with the available data.

Designing Taxes and Tax Reform

Many of the considerations of the previous two sections can be brought together into an analysis of "tax reform." Tax reform analysis is essentially a cost-benefit analysis of marginal tax changes with the aim of selecting those directions that will improve the general welfare. Unlike optimal tax analysis, it does not attempt the more ambitious task of achieving a welfare optimum. In consequence, a tax reform that appears to be favorable may well be dominated by many other more favorable but unconsidered alternatives. Put another way, tax reform analysis will by itself not tell us which of many possible reforms we ought to choose but only whether any given reform is desirable. However, tax reform analysis has an enormous advantage over optimum tax analysis in its data requirements; it requires data only on two current positions of the economy while optimum calculations require data on the behavior of the economy at the welfare optimum, a point that is in all likelihood far removed from anything so far experienced. And as we shall see, even the limited requirements of tax reform analysis are greater than can be met from a single household survey.

The range for policies that can be considered is extremely wide. The most obvious are the day to day policy questions of indirect taxes on consumer goods. In most developing countries, there is a limited range of commodities that can be directly taxed, but the need for government revenue is often severe, and it is important for policy makers to have some sensible method for trading-off the revenue benefits of raising taxes on the one hand with their consequences for worsening poverty on the other. In many countries, a high proportion of revenues comes from import and export taxes, and there are taxes on various forms of intermediate goods, and taxes on production, for example in the form of procurement policies requiring farmers to sell to the government some portion of their crop at below market prices. All of these are ultimately borne by consumers, and the effects of changing rates can be handled by the general methods outlined below.

The benefits of any tax increase accrue in the form of revenue increases to the government. While different revenues may be used for different purposes - for building roads and hospitals, for repaying debt, or for subsidizing basic needs - a rational government will make some attempt to satisfy the most urgent of these first, and ultimately to equate the marginal value to society of different uses of government funds. It is therefore not unreasonable to consider that the marginal unit of revenue has some sort of notional worth to society independent of its disposition. Indeed, it is often convenient to use this value as a numeraire for comparing other uses of funds, so that, for example, we can consider the question of whether an additional unit of government revenue is more or less desirable than the same amount of money in the hands of various other members of society. This, of course, is

the comparison that has to be made in computing the desirability of a tax change. The change will transfer money from consumers of the good to the government, and a judgment must be made as to whether the transfer is worthwhile. Let us examine this in more detail to see where it is that the information from household surveys is useful.

The revenue that comes from a small tax change depends on the amount of the good consumed and on the response of that amount to the change in price induced by the tax. Total consumption will usually be known, particularly if the good is already being taxed, although surveys could conceivably be useful if a tax is being considered on a hitherto untaxed commodity. The elasticity of demand is something that cannot generally be estimated from household budget data, although there are some surveys where it may be possible to use regional price variation, see for example the papers by Timmer (1981), Alderman and Timmer (1979), and Pitt (1983). But it is on estimating the other side of the account, the effects of taxes on those who pay them, that the household survey data become central. Clearly, the taxes are borne by those who consume the good, and are more or less heavily borne depending on how heavily the good is consumed. Hence, if policy makers wish to calculate just how the tax will fall, it is essential for them to know just who it is that consumes the good. For example, it is often argued that it is necessary to subsidize public transport because of the difficulties faced by the poor in going to work in some of the larger conurbations in the Third World. This may be so, but it is important to establish the fact by producing household survey data showing that the poor do in fact benefit from the subsidies. If the data show that the poor usually walk to work, then the subsidies cannot usually be justified on distributional grounds. At this point, middle class interests

are frequently defended by the claim that, "but in our country, everyone is poor", a claim that is of course irrelevant for assessing who should bear the costs of government expenditures.

A policy exercise might therefore be as follows. At the first stage a list of commodities is drawn up that are either being taxed or could potentially be so, either directly or indirectly, for example, through an export tax as in the case of rice in Thailand. For each commodity, policy advisors calculate an estimate of the tax change necessary to increase government revenue by some fixed amount, the same for all commodities, taking into account both the total consumption of the commodity and its price elasticity of demand. Household surveys are then used to calculate the consequences of each of these tax changes for consumers in the economy. One simple procedure would be to represent the population by a series of "representative" households each standing in for a particular socioeconomic group thought to be of relevance to the decision. An obvious possibility would be to take a representative upper-income urban household, together with their three rural counterparts. However, there will often be other special interest groups that need to be represented, if only on political grounds, while for some specific price changes, rather narrow groups may be affected. For example, the production of some commodities (fish, woven goods) is often very geographically concentrated, so that taxes on these goods are likely to have very specific regional consequences. But given the various representative households, the effects of raising an equal amount of revenue through each of the instruments can be calculated in the form of the amount of money that could be directly taken from the household that would reduce welfare by as much as the hypothetical tax change. Since tax changes affect

households by increasing prices, the measures that we need are those discussed in the previous subsection, that is the various compensations for price changes.

These are all the data that are required for evaluating any given tax reform. If achieving the specified increase in revenue by any one tax hurts all the representative consumers by more than by some other tax, then it is clearly a good idea to cut that tax, and to gather the revenue by increasing the other. Of course, the more usual case will be one in which some taxes hurt some people more than others, with different patterns for the different ways of raising government revenues. In these cases, policy makers may simply be able to decide on a policy reform simply by looking at the patterns over the different types of households, particularly if some favored groups are singled out by particular instruments. If not, it will generally be necessary to resort to some sort of distributional weighting scheme, in which compensations to the various household types are given different social values. Once these weights are given - and there are many schemes for calculating them - the weighted compensations can simply be added up and the tax structure adjusted accordingly.

As most readers will have noticed, these procedures share much with standard methods in cost-benefit analysis, particularly with the procedures suggested by Little and Mirrlees (1974), see also Squire and van der Tak (1975). The models underlying tax reform and cost-benefit analysis are formally identical, the only difference being that, in cost-benefit analysis, consideration is given to changes in quantities (a new road, hospital, factory, or whatever), while in tax reform analysis, we are dealing with

changes in prices. The recent work on tax reform, therefore, is no more than extension of standard methods of cost-benefit analysis to the examination of systems of pricing and taxation.

Notes for Further Reading

The index number and consumer surplus theory discussed in this chapter is standard; a full discussion of the material is given in Chapter 7 of Deaton and Muellbauer (1980) which also contains references to the other literature. There is much current work on the evaluation of taxes for developing countries and much of this is collected together in the book edited by Newbery and Stern (1986).

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