# Guidelines for Constructing Consumption Aggregates For Welfare Analysis

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We would like to acknowledge the invaluable assistance provided by Ludovico Carraro in analyzing the data sets from the country case studies reviewed in this paper, and in documenting the programs included in the appendix. We are grateful to Martin Ravallion for discussions on the relationship between money metric utility and welfare ratios. For their helpful comments on previous drafts we would like to thank Martha Ainsworth, Javier Ruiz-Castillo, Lionel Demery, Paul Glewwe, Margaret Grosh, Jesko Hentschel, Manny Jimenez, Jean Olson Lanjouw, Raylynn Oliver, Giovanna Prennushi, Martin Ravallion, and Kinnon Scott.

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## 1. INTRODUCTION:

Poverty is a complex phenomenon involving multiple dimensions of deprivation, of which the lack of goods and services is only one. Even so, there is a good deal of consensus on the value of using a consumption aggregate as a summary measure of living standards, itself an important component of human welfare. In recent years, in much of the World Bank's operational work as well as in applied research, consumption aggregates constructed from survey data have been used to measure poverty, to analyze changes in living standards over time, and to assess the distributional impacts of various programs and policies.

Despite this widespread use of consumption aggregates, there is little in the way of guidelines on how to construct consumption aggregates from survey data. Researchers and analysts interested in using consumption as a welfare measure must often work from whatever documentation exists from earlier exercises, and in some cases, full descriptions are missing. In consequence, there has been a good deal of unnecessary replication with each analyst working afresh through the underlying theoretical and practical issues. This paper seeks to fill the gap by providing a brief theoretical introduction followed by practical advice on how to construct a consumption aggregate from household survey data.

We recognize that there are several distinct audiences for these guidelines, who will use different parts of what follows, with different kinds of surveys, and for different purposes, so that it is useful to start with something of a road map:

**Audience**. We hope that these guidelines will be useful, not only to those whose immediate task is to use a survey (or surveys) to construct consumption aggregates, but also to statisticians, economists, or advisors who are interested in why consumption aggregates might be useful and the general features of their construction. This latter group includes those in Statistical Offices who might be considering instituting a new consumption survey, or in modifying an old one. The arguments for and against consumption, usually in comparison with income aggregates, come up often enough that is useful to have guidelines on the main arguments, and on what is involved in constructing a consumption aggregate. The first part of these guidelines, which outlines the underlying theory, as well as the Summary Boxes, will be of most interest to this group. Issues of survey and questionnaire design are *not* dealt with in these guidelines but are dealt with in the companion piece by Deaton and Grosh (1998). At the same time, we have tried to discuss most of the detailed decisions that would have to be made by our first audience, those actually doing the calculations. There is illustrative code in the

Appendix covering much of what has to be done, and there is discussion of most of the practical issues that have arisen over the years. But it is important that the calculations not be done mechanically. Each survey is different from every other survey, if only in detail, and each country has its own institutions that need to be taken into account. Constructing consumption aggregates without knowledge of the country and its institutions will not give useful results. In consequence, analysts need to be familiar with the theory in order to be able to make sensible decisions when a new problem presents itself, as is always the case in practice.

**Surveys: LSMS versus others?** These guidelines have been prepared by and for the LSMS group in the Bank, and the examples in the Appendix are drawn from LSMS surveys around the world. Whenever we require a specific example, we take it from some LSMS survey, and we generally assume that some version of LSMS protocols have been used. However, we believe that these choices should not compromise the usefulness of the guidelines for those who are constructing consumption aggregates from other surveys. The theory is general, and almost all of the details of the construction would have to be followed through in one form or another using any consumption survey. It should also be noted that as the number of LSMS surveys has grown, there has been a great deal of variation in survey design, so that there are very few consumption surveys around the world whose design would not be represented in one or more LSMS surveys. A more serious issue is that many non-LSMS surveys will lack at least some of the information used in constructing a comprehensive measure.

**Purpose and context.** In what follows, we typically assume that the consumption aggregates will be used in poverty analysis, identifying the poor, and computing standard measures of poverty and inequality. Such aggregates are also used for incidence analysis, to identify the position in the income distribution of those who are likely to benefit or lose from some policy, such as subsidies or taxes, or the provision of a service. We discuss the procedures that would normally be followed in constructing a consumption aggregate for such purposes. However, we shall encounter a number of examples where procedures will have to be modified depending on the context and purpose. For example, some of the theoretically ideal concepts are hard to implement, and because the best is sometimes the enemy of the good, we will often recommend not trying to implement the theoretically ideal solution. But there will always be cases where the purpose of the exercise is compromised by such a decision, and attempts must be made. For example, it is very difficult to measure the welfare effects of public good provision, and we recommend against the routine inclusion of such valuations in the consumption aggregates. But if the aggregates are to be used to examine the effects of public good provision on (for example) the regional distribution of poverty, then some attempt must be made. Again, the theoretical framework is the ultimate guide as to what to do.

The rest of the paper is laid out as follows: The theoretical framework underlying the use of the consumption aggregate as a welfare measure is briefly reviewed in Section 2, along with a discussion of some issues pertaining to what such a measure should include. Specific guidelines on how to construct a consumption based measure of welfare are then presented in Sections 3–5. The paper outlines a three-part procedure for the construction of a consumption-based measure of individual welfare: the various steps involved in aggregating different components of household consumption to construct a nominal consumption aggregate are laid out in Section 3. The construction of the price index in order to adjust for differences in prices faced by households is then reviewed in Section 4. The adjustment of the real consumption aggregate for differences in composition between households is then presented in Section 5. Finally, Section 6 provides examples of some of the analytic techniques that can be used to examine the robustness of the measure to assumptions and choices made at the construction stage.

The consumption aggregates constructed in recent years from the Living Standards Measurement Study (LSMS) survey data from eight countries: Ghana, Vietnam, Nepal, the Kyrgyz Republic, Ecuador, South Africa, Panama, and Brazil were reviewed for this paper (for a brief introduction to the LSMS project as well as a description of the main survey instruments typically used in these surveys, please consult the appendix). In none of the countries covered did we find the procedures followed to be fully in conformance with the recommendations provided in this paper; nonetheless, these case studies provided the basis for much of the practical advice and recommendations presented in the paper. The programs used to construct the consumption aggregates in these countries are included in the appendix as they provide useful illustrations of the general steps involved in constructing the aggregates.

## 2. THEORY OF THE MEASUREMENT OF WELFARE:

### 2.1 INTRODUCTION:

In this section, we discuss briefly the theoretical basis for the consumption-based measure of welfare whose detailed construction is explained elsewhere in the report. Our concern here is a fairly narrow one, focusing on an economic definition of living standards. We do not consider other important components of welfare, such as freedom, health status, life-expectancy, or levels of education, all of which are related to income and consumption, but which cannot be adequately captured by any simple monetary measure. Consumption measures are limited in their scope, but are nevertheless a central component of any assessment of living standards.

One important concept here is *money metric utility,* Samuelson (1974), which measures levels of living by the money required to sustain them. We start with this in Section 2.2 below. An alternative approach, based on Blackorby and Donaldson's (1987) concept of *welfare ratios*, whereby welfare is measured as multiples of a poverty line, is presented in Section 2.3. Each of the money-metric and welfare-ratio approaches has its strengths and weaknesses; both start from a nominal consumption aggregate, but adjust it differently. These first subsections cover the basic ideas, and are followed by subsections on a range of theoretical issues that repeatedly come up in practice. A fuller, and only slightly outdated, treatment is given in Deaton (1980) in one of the earliest LSMS Working Papers (no. 7). Our treatment here skips theoretical developments that are of limited relevance in practice given the data that are typically available, or that can be calculated. For example, we make no systematic use of shadow prices, since in most of the relevant cases, it is difficult to calculate them with any accuracy.

### 2.2 MONEY METRIC UTILITY:

The starting point is the canonical consumption problem in which a household chooses the consumption of individual goods to maximize utility within a given budget and at given prices. Consumer preferences over goods are thought of as a system of indifference curves, each linking bundles that are equally good, and with higher indifference curves better than lower ones. A given indifference curve corresponds to a given level of welfare, well-being, or living-standards, so that the measurement of welfare boils down to labeling the indifference curves, and then locating each household on an indifference curve. There are many ways of labeling indifference curves. One possibility would be to take some reference commodity bundle and to label indifference curves by the distance from the origin of their point of intersection with the bundle. In Figure 1, the reference quantity vector is shown as the line $q^0$ so that the two indifference curves *II* and *JJ* are labeled as *OA* and *OB* respectively. Instead of a reference set of quantities, we can select a reference set of prices, and calculate the amount of money needed to reach the two indifference curves; this is Samuelson's money metric utility. In the Figure, money metric utility is constructed by drawing the two tangents to the indifference curves, with slope set by the reference prices, so that the costs of reaching the curves are *OC'* and *OD'* in terms of $q_1$ or *OC* and *OD* in terms of $q_2$.

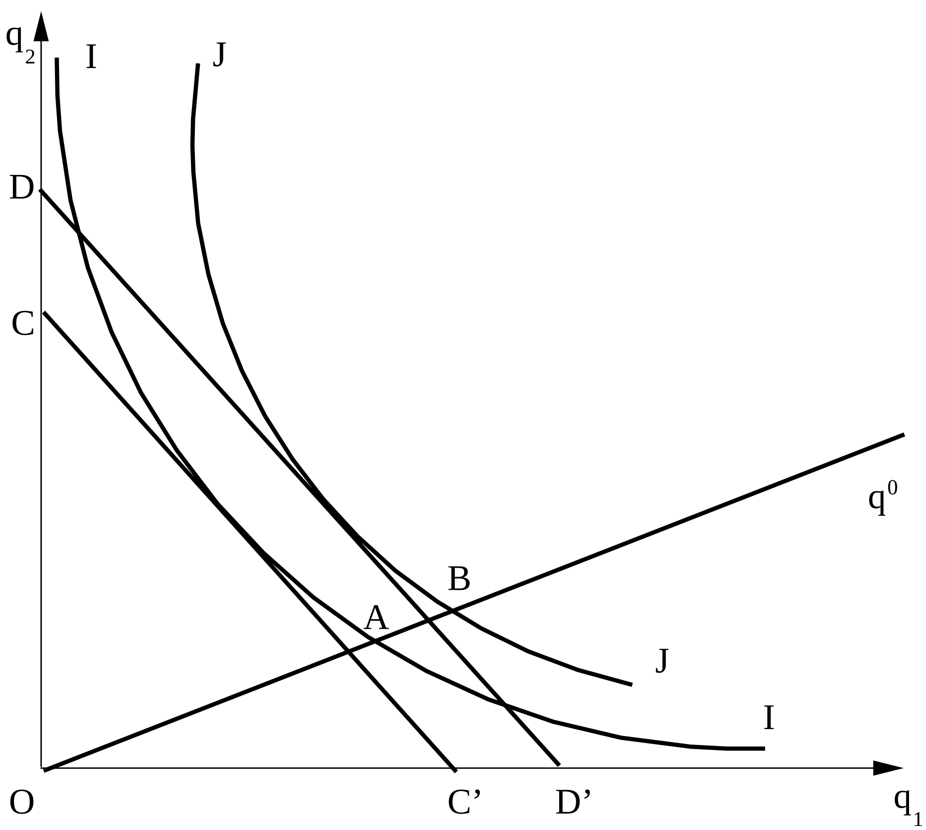



**Figure 1: Two ways of labeling indifference curves**

To see how this works, we introduce some notation. Write *x* for total expenditure, and denote by $c(u, p)$ the cost or expenditure function, which associates with each vector of prices $p$ the minimum cost of reaching the utility level $u$. Since the household maximizes utility, it must minimize cost of reaching $u$, so that

$$c(u, p) = x. \tag{2.1}$$

Denote by superscript $h$ the household whose welfare we are measuring, and let $p^0$ denote a vector of reference prices, the choice of which we discuss below. Money metric utility for household $h$, denoted $u_m^h$, is defined by

$$u_m^h = c(u^h, p^0) \tag{2.2}$$

which is the minimum cost of reaching $u^h$ at prices $p^0$. Note that, although utility itself is to a large extent arbitrary, we can label indifference curves any way we choose, as long as higher indifference curves are labeled with larger values of utility, money metric utility is defined by an indifference curve and a set of prices, is independent of the labels, and is therefore well-defined given the indifference curves.

The exact calculation of money metric utility requires knowledge of preferences. Although preferences can be recovered from knowledge of demand functions, we typically prefer some shortcut method that, even if approximate, does not require the estimation of behavioral relationships with all the accompanying assumptions, including often controversial identifying assumptions, and potential loss of credibility. The most convenient such approximation comes from a first-order expansion of $c(u^h, p^0)$ in prices around the vector of prices actually faced by the household, $p^h$. The derivatives of the cost function with respect to prices are the quantities consumed, a result known as Shephard's Lemma (or Roy's Identity), see for example Deaton and Muellbauer (1980, Chapter 2). In consequence, if we write $q$ for the vector of quantities, we can approximate the cost function as follows

$$c(u^h, p^0) \approx c(u^h, p^h) + (p^0 - p^h) \cdot q^h \tag{2.3}$$

where the centered "$\cdot$"indicates an inner product. Since the minimum cost of reaching $u^h$ at $p^h$ is the amount spent $p^h \cdot q^h$ , (2.3) can be written as

$$u_m^h = c(u^h, p^0) \approx p^0 \cdot q^h \tag{2.4}$$

which is the household's vector of consumption items priced at reference prices. Note the convenient link with National Income Accounting Practice, in which real national product would include real consumer's expenditure, which is the sum over all consumers of their consumption valued at base prices, i.e. the sum of the right hand side of (2.4) over all agents.

This equation is still not quite in convenient form for practice, since we rarely observe a complete set of *quantities* for each household, and may not even have available a complete set of reference prices. The *Paasche* price index comparing the price vectors $p^h$ and $p^0$ is defined as

$$P_P^h = \frac{p^h \cdot q^h}{p^0 \cdot q^h} \tag{2.5}$$

so that, from (2.4), we have

$$u_m^h \approx \frac{p^h \cdot q^h}{P_P^h} = \frac{x^h}{P_P^h} \tag{2.6}$$

so that money metric utility can be approximated by adding up all the household's expenditures, and dividing by a Paasche index of prices.

For readers who are used to thinking about price indexes as summarizing prices at different points of time, it is perhaps useful to add a few words of explanation about our use of the Paasche (and later Laspeyres) labels for the price indexes used here. When we are working with a single cross-sectional household survey, the price variation is less *temporal* than *spatial*; people who live in different parts of the country pay different prices for comparable goods. (If we have two surveys for the same country at different times, or if the survey is spread over months or years, the variation will be both temporal and spatial.) In industrialized countries, where transportation is easy and inexpensive, and there are integrated distribution systems for most consumer goods, spatial price variation is small, housing being the major exception. But in many developing countries, spatial price differences can be large, in both relative and absolute prices, and it is important to take them into account. In the temporal context, a Paasche price index is one whose (quantity) weights relate to the current period, rather than the base period. In the current spatial context, the "current period" is replaced by the "household under consideration", whose purchases are used to weight the prices it faces relative to some base or reference prices. Perhaps the major practical point about (2.5) is that the weights for the prices differ from household to household so that for example, two households in the same village, buying their goods in the same markets, and facing the same prices, will have different price indexes if they have different tastes or incomes. At first sight, such a situation may seem hopelessly complicated. But the transparency is restored if we think of money metric utility as (2.4), the household's consumption bundle priced at fixed prices, and if we recognize that (2.6), the deflation of nominal expenditure by a Paasche index with household specific weights, as simply a means of calculating the constant price total.

Deriving total expenditure and dividing it by a price index is our basic strategy for using LSMS consumption data to measure welfare. In practice, there are myriad adjustments and approximations to be made, and there are cases where the conceptual framework has to be (slightly) extended. We deal with the most important of these in the rest of this section. Before doing so, however, we must discuss a potential problem with money metric utility, and an alternative approach.

### 2.3 An alternative approach: Welfare Ratios:

One of the important uses of measures of standard of living is to support policy, particularly policy where distribution is an issue. In particular, much policy is conducted on the basis that transfers of money are more valuable the lower in the distribution is the recipient. This may take the form of a focus on poverty where the poor are given preference over the non-poor, or it may be more sophisticated, involving distributional weights that decline as we look at people with higher standards of living. Blackorby and Donaldson (1988) have shown that the use of money metric utility can cause difficulties in this context. To see the problem, start by assuming that total household expenditure (or income) $x$ is a satisfactory measure of living standards, something that would be true if everyone faced the same prices, and everyone lived alone, or at least in households that all had the same size and composition. Monetary transfers then correspond exactly to changes in welfare, so that policymakers who are averse to inequality can work under the assumption that increases in $x$ have a lower social marginal value the higher in the distribution is the recipient. But money metric utility is not $x$, but a function of $x$. As Figure 1 makes clear, money-metric utility is higher the higher is $x$, so that more money corresponds to a higher indifference curve and standard of living. But what Blackorby and Donaldson show is that, special cases apart, money metric utility is not a *concave* function of $x$, that the rate at which money metric utility increases with $x$ can be constant, decreasing, or increasing, and that, in general, which is the case depends on the choice of the reference price vector $p^0$. This has the effect of breaking any close link between redistributive policy and the measurement of its effects. For example, suppose that a change in policy—for example, a transfer policy—has the effect of transferring money from better-off to worse-off households, so that the distribution of money income has become more equal. But because we do not know exactly how money metric utility is linked to money, there is no guarantee that the distribution of money metric utility has also narrowed. So we have lost the ability to monitor the distributional effects of policy, and what we get when we try will be different at different choices of reference prices $p^0$. Since we are often forced to use whatever prices are available to us, we may not even be able to control the outcome.

In order to avoid these problems, Blackorby and Donaldson (1997) have proposed the use of a “welfare ratio” measure in place of money-metric utility; within the Bank, the use of welfare ratios is reviewed by Ravallion (1998). The basic idea is to express the standard of living relative to a baseline indifference curve. In poverty analysis, a natural (and useful) choice is the poverty indifference curve, the level of living that marks the boundary between being poor and non-poor. The welfare ratio is then the ratio of the household's expenditure to the expenditure required to reach the poverty indifference curve, both expressed at the prices faced by the household. Once again, Figure 1 can serve to illustrate. If *II* is taken to be the poverty indifference curve, and *JJ* the indifference curve we are trying to measure, then provided the two price lines are taken to illustrate *current*, not reference, prices, the welfare ratio is *OD/OC* or (equivalently) *OD'/OC'*. In terms of the cost functions, the ratio is given by

$$wr^h = \frac{c(u^h, p^h)}{c(u^z, p^h)} \tag{2.8}$$

where $u^z$ is the utility poverty-line, the utility corresponding to the poverty indifference curve.

Unlike money metric utility, which is a money measure—the minimum amount of money needed to reach an indifference curve—the welfare ratio is a pure number—the standard of living as a multiple of the poverty line. In practice, it is useful to convert the welfare ratio into a money measure, and again the obvious procedure is to multiply the ratio by the poverty line, defined as the cost of obtaining poverty utility at reference prices, $c(u^z, p^0)$. This gives the welfare ratio measure, which we denote by $u_r^h$.

$$u_r^h = \frac{c(u^h, p^h)}{c(u^z, p^h)} \times c(u^z, p^0) \tag{2.8}$$

Like the money metric utility measure, (2.8) is total expenditure $x^h$ divided by a price index, in this case the true cost of living index for $p^h$ versus $p^0$ computed at the poverty line indifference curve. This cost-of-living price index would normally be approximated by the Laspeyres index

$$P_{Lz}^{\mathrm{h}} = \frac{p^h \cdot q^z}{p^0 \cdot q^z} = \sum_{i=1}^{n} \frac{p_i^0 q_i^z}{p^0 q^z} \left(\frac{p_i^h}{p_i^0}\right) = \sum_{i=1}^{n} w_i^{z0} \left(\frac{p_i^h}{p_i^0}\right) \tag{2.9}$$

where $q_i^z$ is the quantity of *i* consumed at the poverty line and the weights $w_i^z$ are the shares of the budget at the poverty line indifference curve and prices $p^0$. Putting (2.8) and (2.9) together, we get an expression for the money version of the welfare ratio that corresponds to (2.6) for money metric utility

$$u_r^h = \frac{x^h}{P_{Lz}^h} \tag{2.10}$$

If we compare (2.6) and (2.10), we see that money metric utility involves deflation of expenditure by a Paasche index of prices, while the welfare ratio measure involves deflation of expenditure by a Laspeyres price index. (The calculation of the poverty-line weights in (2.9) will be discussed in Section 4.)

In some applications, such as in comparing national price indexes at two moments of time, Paasche and Laspeyres price indexes are close to one another, either because the two sets of weights are similar in the two periods, or because relative prices are similar. In the current context, where we are most often interested in comparing prices between different places, where both weights and relative prices are often quite different, the Paasche and Laspeyres price indexes will also be different, as will therefore be money metric utility and welfare ratio measures. On the theoretical side, the point to note is that the Laspeyres index in (2.10) is computed at the poverty indifference curve, so that its weights (see also 2.9) are unaffected by changes in total expenditure of household *h*. As a result, $u_r^h$ is proportional to $x^h$, and there is a direct link between redistributive policy and the measurement of its effects. Welfare ratios resolve the difficulties of using money-metric utility to monitor the outcomes of distributionally sensitive policies. On the empirical side, the Paasche and Laspeyres indexes will be close to one another when the price relatives are close to one another over different goods and services, or when the weights applied to them are the same at the base, in this case the poverty line, as for other households in the survey. But there is no reason to suppose that either will be true in cross-sectional surveys. Regional price differences are often markedly different across goods depending on agricultural zones or distance from the ocean, and expenditure patterns differ sharply over households of different types, or even across households that have much the same observable characteristics. In practice, as well as in theory, the money-metric and welfare-ratio approaches are likely to give quite different answers.

How do we choose between the two approaches to welfare measurement? As we have presented it so far, the balance seems to favor the welfare ratio approach. It is simpler to calculate, since the weights for the price index are the same for everyone, and it has a straightforward theoretical link to total expenditure, which facilitates distributional analysis. It is also clear from conversations with Bank staff, that deflation of an expenditure measure by a fixed weight Laspeyres index is a procedure that is both simple and transparent and that could be explained and defended to policymakers.  For some, those benefits are likely to be decisive.

Nevertheless, the welfare ratio approach is not without its own Achilles heel. As Blackorby and Donaldson show, welfare ratios do not necessarily indicate welfare correctly. It is possible for a policy to make someone better off, and yet to decrease their welfare ratio. This cannot happen for money metric utility, no matter which set of reference prices are used in the evaluation. So while money metric utility is more problematic for distributional calculations, the welfare ratio approach throws out at least some of the baby along with the bath-water. Our own choice is to stick with money metric utility, and we recommend at least trying to calculate the relevant Paasche indexes as discussed in Section 4. If this appears to compromise transparency and simplicity, we recommend describing money metric utility according to (2.4) where each household's bundle of goods and services is evaluated, not at the prices they paid, but at a common set of prices. It is also worth noting that, given the difficulties of calculating prices and price indexes in practice, as well as the much graver conceptual and practical problems of dealing with differences in household size and composition, see Section 5, the choice between money metric and welfare ratio utility is likely to be only one of several difficult decisions, and may not be of paramount importance.

### 2.4 Income versus Consumption:

Among economic measures of living standards, the main competitor to a consumption-based measure is a measure based on income. In most industrialized countries, including the U.S., living standards and poverty are assessed with reference to income, not consumption. This tradition is followed in much of Latin America, where many household surveys make no attempt to collect consumption data. By contrast, most Asian surveys, including the Indian NSS and the Indonesian SUSENAS, have always collected detailed consumption data, and are thus closer in spirit to LSMS surveys. There are both theoretical and practical reasons that must be considered when making the choice to use income or consumption to measure living standards.

In the theory outlined in the previous subsection, the choice between income and consumption did not arise because, in a single period model, there is no distinction; all income is consumed, and income and total consumption are identical. With more than one period, the difference between income and consumption is saving, or dissaving, so that in terms of the theory, the choice between income and consumption is tied to the choice of the period over which we want to measure welfare. Over a long enough period of time, such as a lifetime, and provided that we work in present value terms, the average level of consumption (including any bequests) must equal the average level of income (including any inheritances), so that, if the concern is to measure lifetime welfare, the choice does not matter. There is indeed a case to be made for working with a lifetime measure. Many would argue that inequality is overstated by including the component that comes from the variation in living standards with age. According to this view, there is no inequality if, over life, everyone gets their turn to be relatively rich or relatively poor. But the argument for abolishing the concept of age-related poverty is weaker, and policymakers (and their constituents) frequently show concern about child and old-age poverty. Even so, few would argue for very short reference periods for living standards; that someone is "poor" for a day or two is of little concern, since most people have ways of tiding themselves over such short periods. There is more concern about seasonal poverty, especially in agricultural societies with limited or very expensive credit availability. But most standard household surveys are not designed to capture seasonal fluctuations in income or expenditure, and most anti-poverty policies are directed at longer term levels of living. On balance, and for most purposes, there is widespread agreement that a year is a sensible practical compromise for the measurement of welfare. In consequence, we must decide whether it is consumption, income, or wealth, or some combination of all three, that permits the best measure of living standards over a year.

The empirical literature on the relationship between income and consumption has established, for both rich and poor countries, that consumption is not closely tied to short-term fluctuations in income, and that consumption is smoother and less-variable than income. Extreme versions of the smoothing story involve people evening out their resources over a lifetime, something for which there is little convincing evidence. But there is good evidence that consumers can smooth out income fluctuations in the short term, certainly over seasons, and in most cases, over a few years. As a result, in circumstances where income fluctuates a great deal from year to year—as in rural agriculture—the ranking of households by income will usually be much less stable than the ranking by consumption, though exceptions can occur as discussed in Chaudhuri and Ravallion (1994). Even limited smoothing gives consumption a practical advantage over income in the measurement of living standards because observing consumption over a relatively short period, even a week or two, will tell us a great deal more about annual—or even longer period—living standards than will a similar observation on income. Although consumption has seasonal components—for example, those associated with holidays and festivals—they are of smaller amplitude than seasonal fluctuations in income in agricultural societies. In such communities, it is usually not possible to get a useful measure of living standards based on income without multiple seasonal visits to the household, something that has rarely been attempted within LSMS protocols. In seasons when people have little or no income, their consumption is financed from assets, or from credit, so that an alternative way to measuring living standards without consumption data would be to gather data on income and assets. But assets are typically difficult to measure accurately, so that this is not usually a practical alternative.

There are several other reasons why it is more practical to gather consumption than income data in most countries where an LSMS is being run. Where self-employment, including small business and agriculture, is common, it is notoriously difficult to gather accurate income data, or indeed to separate business transactions from consumption transactions. Income from self-employment is hard to measure in industrialized countries too, but self-employment is rarer relative to wage income, so that, for most households, a fairly accurate picture of household income can be obtained from only a few questions covering different types of income. In the U.S., it costs five times as much per household to collect consumption (and other) information in the Consumer Expenditure Survey (CEX) as it does to collect income (and other) data in the Current Population Survey (CPS). As a result, the CPS can be much larger than the CEX, and it is the former that is used for poverty statistics because of the greater regional and racial disaggregation that the larger sample can support. In developing countries, the calculation of income often requires the measurement of all own-account transactions, sometimes with multiple visits, as well as a host of assumptions about such matters as the depreciation of tools or animals. Consumption data are expensive to collect in poor countries as in rich, but the concepts are clearer, the protocols are well-understood, and less imputation is required. Perhaps in consequence, there is a long tradition of successful and well-validated consumption surveys in developing countries.

One argument that can be made for income is that it is often possible to assign particular sources of income to particular members of the household; for example, earnings from the market can be attributed to the individual who did the work, and pensions are typically “owned” by an identifiable member of the household. By contrast, consumption is only occasionally measured for individual household members. While many studies in the literature have made good use of such income data to study allocation within the household, and to examine the effects of who “owns” the income on purchases, it should be clear that there is no very clear link between individual welfare and individual income. Earners or pensioners share their incomes with non-earners and non-pensioners, so that the attribution of individual welfare from individual income requires some sort of imputation scheme, just as it does for consumption. Although we shall discuss issues of how to adjust welfare for household size and composition in Section 5 below, we provide no guidance on how to use survey data on either consumption or income to study the allocation of resources within the household. Such allocations are often best studied through other measures, for example anthropometric or educational status, though there is an extensive (though only occasionally successful) literature on using household consumption data to make inferences about intrahousehold allocation, see Deaton (1997, Chapter 3) for a review and discussion.

### 2.5 DURABLE GOODS:

Because durable goods last for several years, and because it is clearly not the *purchase* of durables that is the relevant component of welfare, they require special treatment when calculating total expenditure. It is the *use* of a durable good that contributes to welfare, but since use is rarely observed directly, it is typically assumed to be proportional to the *stock* of the good held by the household. In consequence, when we add up total household expenditures during the year, we add to expenditures on non-durables the annual cost of holding the stock of each durable. This cost is estimated from a conceptual experiment in which we imagine the household buying the durable good at the beginning of each year, and then selling it again at year's end. The costs of doing this depend on the price at the beginning of the year, $p_t$, say, its price at the end of the year, $p_{t+1}$, on the nominal interest rate, $r_t$, which is the cost of having money tied up in the good for the year, and on the extent to which the durable good deteriorates during the year. Deterioration is modeled by means of the simple assumption that the quantity of the good is subject to "radioactive decay" so that, if the household starts off the year with the amount $S_t$ it will have an amount $(1-\delta)S_t$ to sell back at the end of the year. Seen from the beginning of the year, the sales at the end of the year must be deflated to put them on discounted present value terms so that, in today's money, the discounted present cost (negative profit) of the transaction is

$$S_t \left( p_t - p_{t+1} \frac{1-\delta}{1+r_t} \right) \tag{2.11}$$

so that the cost of maintaining the stock—which is what we need to add up total expenditure—is approximately (provided the interest rate and depreciation rate are small)

$$S_t\, p_t (r_t - \pi_t + \delta) \tag{2.12}$$

where $\pi_t$ is the rate of inflation of the durable good price, $(p_{t+1} - p_t)/p_t$. If it is assumed that the rate of inflation of the durable good is the same as that of other goods, the first two terms in the bracket give the real rate of interest, so that the "price" for the use of the durable good for a year is its current price multiplied by the sum of the real interest rate and its rate of deterioration. This is typically referred to as "user cost" or, since it would be the rental charge for the durable in a competitive market, as the "rental equivalent." In Section 3.4 below, we discuss how the elements of (2.12) are computed from the LSMS data.

Note that the approach based on user cost makes no allowance for the (often considerable) transactions costs involved in buying and selling durable goods, particularly used durable goods. Such costs mean that households cannot easily take advantage of temporarily high real interest rates by reallocating their portfolios away from durables and holding money or other assets. Given this, it is important not to make user cost too sensitive to market fluctuations in real interest rates, and this can be accomplished by using, not today's real interest rate, but some average computed over a number of years.

One of the most important durable goods for many households is housing itself. Many people rent their accommodation, in which case the "rental equivalent" is actual rent, which is gathered in the surveys and added into the consumption total. For those who own their housing, the method for other durables can sometimes be used, if people have some idea of what their house is worth, or the rental rate can be imputed by observing the rental costs of similar units. In Section 3.5 below, we discuss how this is calculated from the data gathered in LSMS surveys.

## 2.6 THE EVALUATION OF TIME AND LEISURE:

It is often pointed out that people's levels of living depend, not only on how much they spend, but also on the amount of leisure they have, so that using a pure consumption measure could be misleading. For example, if two people have the same income and expenditure, but one has a two hour daily commute to get to work, and the other none, they are not equally well off. Similarly, single-parent households with children are likely to be short of non-market time compared with two-parent households with the same income and expenditure. Adding in an allowance for the value of leisure or of non-market work could eliminate these anomalies.

The theory in Section 2.2 can readily be extended to tell us what to do. In the single period model, where work is available at a constant wage rate *w*, the budget constraint for goods and leisure becomes

$$p \cdot q = w(T - \ell) + y \tag{2.13}$$

where T is the total time endowment, $\ell$ is time spent in leisure, and y is income that is not associated with time in the market. Rewriting this gives

$$p \cdot q + w\ell = wT + y \tag{2.14}$$

so that leisure takes its place with the other goods, with price *w*, and the budget constraint says that expenditures on all goods, including leisure, must be no more than "full income," defined as non-market income plus the value of the time endowment. Leisure can then be incorporated into the welfare measure by working not with expenditure on goods, *x*, but with expenditure on goods and leisure together.

This is correct as far as it goes, but if welfare measurement stops here, simply replacing expenditure with full expenditure, a serious error will have been made. In the theory at the beginning of this section, money metric and welfare ratio utility were measured, not by expenditures $x$, but by $x$ divided by a price index. In those situations where the prices of goods do not differ much across households, which apart perhaps from housing is the normal situation in industrialized countries, a welfare ranking of households according to $x$ will be very similar to a welfare ranking according to $x$ deflated by the price index. But once leisure is introduced, the situation is quite different, because the price of leisure, the wage rate, differs across people. Rankings by full expenditure are therefore very different from rankings by deflated full expenditure, where the deflator includes the wage as one of the prices. By the failure to deflate, the welfare of high wage people is overstated, and the welfare of low wage people understated. A high wage rate not only makes the time endowment more valuable—which is taken into account in full income or full expenditure—but it also makes leisure more expensive—which is not. *It is incorrect to assess individual or household welfare levels using full income or full expenditure as a measure of welfare*.

Suppose that the error is avoided, and a price index including the wage is constructed which is then used to deflate full expenditures. In some circumstances, the resulting welfare measure will be better than one based on expenditures ignoring leisure. But there are also a number of problems that cause us not to recommend this procedure in general. The first is that the results are sensitive to the value assumed for the time-endowment, $T$; should this be 24 hours for each day, or should it be something less, to allow for sleep and "minimal personal maintenance?" More serious still is the real possibility that the simple model of labor supply that underlies the calculations may be at odds with the facts. For example, suppose that we find an adult in the survey who does not work. According to the model, this person is voluntarily allocating resources to leisure, and although we don't observe that person's wage—because he or she is not working—we can impute some value based on the person's education and experience, or using the wages received by other similar people who are working. But this person might be unemployed, and unable to find work, or may be able to find work only at wages that are much lower than those who are working, and whose wages we are using to value "leisure." It adds insult to injury to class unemployed people as well-off by imputing to them a value of leisure based on wages in a formal sector to which they have no access.

Because of these dangers, we believe that the attempt to value leisure introduces more problems than it is likely to solve, and may compromise the integrity and general credibility of the welfare measures produced from the survey data. Of course, we are not disputing that leisure is valuable, nor that there will be specific cases where assigning some value to it will generate useful supplementary evidence on levels of living. Indeed, time-use data, when available, are a valuable complement to consumption aggregates for studying welfare. They allow us to identify those—such as people who must travel long distances to work, or women who must combine childcare with market work—whose welfare is incorrectly assessed by their consumption alone, and permit at least rough-and-ready corrections in circumstances where such cases are a focus of interest.

### 2.7 PUBLIC GOODS AND PUBLICLY SUPPLIED GOODS:

Another important contribution to living standards that is ignored by private consumption is that made by publicly provided goods, the most important of which are education and health, but which also include such things as police, water, sanitation, justice, public parks, and national defense. The major problem with including these is finding a set of prices (or shadow prices) that reflects what they are worth to each household. One approach to estimating prices is to look for effects of the provision of public goods on the demand for private goods. For example, we might be able to assess the value of a new public clinic by seeing how much less people spend on private doctors or clinics. But it is clear that this line of investigation, although useful in some cases, cannot work in general. If the publicly provided good is separable in preferences from private consumption, or if part of it is separable, changes in the provision of the former (or in its separable part) will have no effect on the latter. In consequence, there is no hope of computing the full shadow price based on observable behavior. The other approach, which has recently become popular in the project evaluation literature, is to ask people how much they would be prepared to pay for an additional unit of the good. Whether such "contingent valuation" procedures yield useful numbers remains controversial among both economists and psychologists, see Hanemann (1994) for the arguments in favor, and Diamond and Hausman (1994) for the (much more convincing) arguments against. As with the imputation of leisure, we believe that imputations for public goods are likely to compromise the credibility and usefulness of welfare measures in general. None of which gainsays the fact that the documentation of who gets access to publicly provided goods and services, and whether these people are poor or rich, remains an important element in any overall assessment of living standards and poverty.

It should be noted that there are some cases where the necessity to make some allowance for public goods cannot be avoided. The most obvious case is when making international comparisons where in one country, some good—health and housing are the obvious examples—is publicly provided or subsidized, while in the other it is obtained through the market. Even within a country, urban residents may have access to subsidized hospitals, clinics, or "fair price" shops that are not available in the countryside. Given the difficulties of measurement, and the variety of possible cases, it is impossible to make useful general recommendations about how imputations might be done. It will sometimes be enough to be aware of the problem and its implication for certain types of welfare comparisons; in other cases, it will be necessary to try to revalue consumption at international or unsubsidized prices, even if such imputations carry a large margin of error.

### 2.8 Farm households:

Many households in developing countries are not only consumers of goods and services, but also producers. Many people have small, own-account business, and many more are farm-households who produce goods, sometimes for the market, and sometimes for their own consumption. The standard approach to these mixed entities is to split them into a consumption unit and a production unit. This can be done under the conditions of the "separation" property, see Singh, Strauss, and Squire (1976). If markets are perfect, so that all factors are perfectly homogeneous and can be bought and sold at fixed prices in unlimited quantities, then a farm-household behaves exactly as if it were the sum of a farm, which maximizes profits at given market prices, and a household, which chooses its consumption bundle so as to maximize its welfare at fixed prices and subject to its income, including the profits from its farm. The assumptions of the separation theorem are more obviously appropriate to the owners of an agribusiness who live in New York city than to most subsistence farm households in developing countries, or elsewhere. Family labor is not the same as hired labor, work may not always be available at "the" wage, and the costs of transport to and from work may reduce the effective price of work on the home farm. All of these issues can be dealt with by suitable modifications of the theory, but only at the cost of introducing shadow prices that are even more difficult to observe and to calculate than the actual prices, the collection of which itself imposes considerable difficulty.

In practice, it is difficult to do better than to treat the household and its business as conceptually distinct units, and to value the sales from one to the other at some suitable prices. These prices are of course not observed for the households for which they are required, but must be imputed from purchases of such goods by other households, or from prices collected in the community questionnaire. This tends to be a very approximate business, so that it is perhaps unreasonable to insist too strictly on abstract considerations. Nevertheless, it is worth noting that market prices often include an element of transport and distribution costs that should not be included when evaluating consumption from home production; "farm-gate" not "market" prices are appropriate for imputation. It is also necessary to be careful about quality comparability; home produce may (or may not) be of lower quality, and water from the local pond is certainly different from *L'Eau Perrier*.

As we shall see below, imputations are typically rough and ready and subject to a good deal of inaccuracy. In countries where a large fraction of food consumption comes from home production—see Table 3.1 for examples—imputations, and the role of the separation theorem, can generate considerable discomfort with the resulting calculations. The methods of this paper make most sense where markets are active, and where the standard neoclassical model is a good approximation to reality. For many non-monetized subsistence economies, this is hardly the case. In such economies, the ratio of measurement to imputation is often quite low, and there is a real question about whether we are "measuring" or "assuming". And even if imputations are accurate on average—which would be assuming a great deal—they tend to be less variable than would be the true data, so that their use tends to understate inequality and (in most cases) poverty. Money metric and welfare-ratio measures of welfare were developed to measure living standards for households who obtain their goods and services through the market and make the best choices that their incomes will permit given the prices that they face. In peasant economies, this neoclassical model is often a poor approximation to reality, and welfare measurement based on a consumption aggregate is unlikely to be either accurate or useful. Once again, we have no useful counsel except to be aware of the issue, and sometimes to be prepared to concede defeat.

### 2.9 Differences in tastes across people and households:

The theoretical framework of Section 2.2 works with a single set of preferences, so that when we rank different households according to their money metric utility, we are locating their different expenditures levels on the same set of indifference curves. Since different people have different tastes, it is not clear why this is the correct thing to do.

One argument is that there is little interest in evaluating any individual's welfare according to his or her own lights, but that we need to know about the welfare of a reference person given the circumstances of the individual. Hence, we need a reference set of preferences, as well as a reference set of prices. The answer to the question "How well-off would John Doe be with household *h*'s income?" is of more general interest than allowing the idiosyncrasies of each person's tastes to affect the evaluation of his or her resources. For example, greediness makes a given income worth less, but we would hardly count someone as poor just because their income did not match their greed. More seriously, altruists are not deemed to be rich because their neighbors are rich nor, in the same circumstances, are the envious deemed to be poor.

Nevertheless, there are some taste factors that affect the translation of money into welfare for everyone, and that are usually recognized in assessing welfare. Health status is one such and a person who needs to spend a great deal of money for life-saving surgery or simply to stay alive would not be deemed to be rich because of such expenditure. But in practice, the most important taste-like factor that must be allowed for is household size and composition. There is a useful analogy here with prices; prices, like needs, moderate the way in which expenditures on each good generate welfare. If the price of rice is three times as high, 50 rupees can only buy a third as much rice. Similarly, 50 rupees worth of rice buys only a third as much per person in a household of three persons as in a household of one. According to this analogy, expenditure must not only be deflated by a price index that reflects variations in the costs of goods and services, but it must also be deflated by some measure of household size in order to assess individual welfare. Section 5 is concerned with how to construct the appropriate measures.

There is another issue about taste variation. This is the question of “regrettable necessities,” goods and services that yield no welfare in their own right, but that have to be purchased, for example, in order to earn income. Work clothes or transport to work are obvious examples, and the argument is that such items should be deducted from income rather than included in consumption. If this is not done, individuals with different expenditures on regrettable necessities will not be correctly ranked if we rely only on their total consumption inclusive of such expenditures. Again, the theoretical validity of such points should not blind us to the practical difficulties. Transport to work is a regrettable necessity for someone who has little choice of where to work or where to live, but is consumption for someone who chooses to live in a pleasant suburb. Out-of-pocket medical expenses are a necessity for some, but a choice for others, as in curative versus cosmetic medicine. It is hard to see how guidelines could be constructed that would allow one and not the other. The issue here is essentially the same as that facing a tax authority when deciding what expenses should be allowed as deductions against income in the computation of income tax. While recognizing the occasional injustice, such authorities tend to take a hard line on such deductions in order to avoid large scale abuse. Exactly the same arguments apply here.

**Box 1. Summary of Theoretical Issues and Recommendations**

| Issue | Recommendation |
|---|---|
| **Money Metric Utility (MMU) vs. Welfare Ratio(WR)**<br><br>MMU is the amount required to sustain a level of living and requires that consumption be adjusted by a Paasche price index that reflects the prices the household faces and whose weights are different for each household.<br><br>WR is an indication of how much better or worse off a household is than a reference household (usually at the poverty line) and requires consumption to be adjusted by a Laspeyres price index that reflects the prices faced by the reference household but whose weights are the same for all households.<br><br>The use of MMU can cause difficulties in analyzing the impact of redistributive policy but, on the other hand, WR does not necessarily represent welfare correctly. The latter is the more serious drawback in practice. | Attempt should be made to use Money Metric Utility and to calculate the Paasche price indices with individual household weights. |
| **Income vs. Consumption**<br><br>Consumption is a theoretically more satisfactory measure of well-being<br><br>Income is used in industrial countries where self-employment is relatively rare so that most household income comes from a few sources, where annual income variation is low, and consumption data are relatively costly to gather.<br><br>Consumption is less variable over the period of a year, much more stable than income in agricultural economies and makes it more reasonable to extrapolate from two weeks to a year for a survey household. When self-employment is common, income data is at least as expensive and as difficult to collect as are consumption data. | In most developing countries where LSMS and / or household expenditure surveys are available, consumption is the appropriate measure to use. |
| **Durable Goods and Housing**<br><br>A measure of use-value, not purchase, of durable goods is the right measure to include in the consumption aggregate from a welfare point of view. | Exclude expenditures – instead, calculate a rental equivalent / user cost for housing & durable goods owned by the household. |
| **Time and Leisure**<br><br>Households with more leisure time have a higher level of welfare than households with no leisure.  However, valuing leisure for each individual is problematic.  Furthermore, it is difficult to distinguish between leisure, non-market work for the household, and involuntary unemployment. | Omit time and leisure in the calculation of consumption. |

| Issue | Recommendation |
|---|---|
| **Public Goods**<br><br>Clearly presence of public goods such as hospitals and schools improves the welfare of nearby households more than that of households without good access to these services. However, estimating the value of those services is problematic. Households may choose private services even if public services are available. Contingent valuation of services that don't exist are sometimes used but of questionable accuracy. | Do not include any valuation of public goods in the calculation of the household consumption aggregate. |
| **Farm Households**<br><br>It is possible to consider households as consumers separately from household businesses or farms in economies with active markets. In subsistence economies, this assumption is sometimes hard to justify; however trying to separate the producer from the consumer using estimates of farm-gate prices is the best strategy in practice. In countries where a large fraction of consumption comes from home production, and markets are less active, the evaluation of welfare becomes sensitive to difficult decisions about imputations, and should be regarded with caution. | Treat the farm household as a business selling to the household. Attempt to value produce at "farmgate" rather than "market" prices. |
| **Differences in Tastes**<br><br>Expenditure on regrettable necessities should, in theory, be excluded but in practice it is impossible reliably to distinguish between necessities and choices. Household size, however, is important and affects the household welfare associated with a given level of expenditure. | Include expenditure on items that may or may not be regrettable necessities. Adjust household expenditure to reflect household size. |

## 3. CONSTRUCTING THE HOUSEHOLD CONSUMPTION AGGREGATE:

### 3.1 INTRODUCTION:

Following the discussion of the basic theoretical framework implicit in using consumption as a measure of welfare, this section provides specific guidelines that the analyst can follow to construct a nominal consumption aggregate from a typical LSMS household survey. For the purposes of this paper, the procedures followed in constructing the consumption aggregate from recent household surveys in the following countries were reviewed in detail: Vietnam, Nepal, Ghana, the Kyrgyz Republic, Ecuador, South Africa, Panama, and Brazil.

One important preliminary issue should be emphasized, though it is one where it is hard to give any very precise guidelines. This is the issue of data cleaning. In most cases, analysts who are constructing consumption aggregates will be using a "clean" set of data that has already been subjected to the usual consistency checks and elimination of gross outliers and coding errors. Nevertheless, experience has shown that every new exercise reveals new problems with the data, and the construction of a consumption aggregate is no exception. As we shall see, the construction of a consumption aggregate involves adding together a large number of items, many but by no means all from the consumption section of the questionnaire. It is of the greatest importance that the analyst check each of these items for the presence of "gross" outliers, typically by graphing the data, for example using the "oneway" and "box" options in STATA. For inherently positive quantities, it is often useful to do this in logs as well as in levels. Aggregates and sub-aggregates should similarly be checked. Such checks often reveal, not only isolated outliers, but groups of outliers, for example if the units have been misinterpreted for all observations in a cluster. Sometimes, outliers can clearly be attributed to coding errors, as when the units have been misinterpreted, or where zeros have been added, and in such cases it is routine to impute an average (or better median) value for other households in the same cluster or region. In other cases, it is unclear whether the "outlier" is genuine or not, and the analyst must make a judgment that balances the desirability of keeping any reasonable number against the risk of contaminating the aggregate.

In Table 3.1, the components of consumption are aggregated into four main classes: (i) food items, (ii) non-food items, (iii) consumer durables, and (iv) housing. The relative importance of each of these classes in the overall consumption aggregate depends on many factors, including the average level of income in the country, prevalent tastes and norms, as well as the types of data collected in the survey. In this regard, it should be noted that there was considerable variation in the design of questionnaires across the various countries, so that the aggregates do not always include the same items. Nonetheless, the table is indicative of the order of magnitude and relative importance of the sub-aggregates.

**Table 3. 1: Main components of the consumption aggregate**

| Sub-aggregate | Share of consumption aggregate (per cent) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Vietnam 1992-93 | Nepal 1996 | Ghana 1988-89 | Kyrgyz 1996 | Ecuador 1994-95 | S. Africa 1993 | Panama 1997 | Brazil 1996-97 |
| **Food** | **50.9** | **64.2** | **65.2** | **44.5** | **49.6** | **30.4** | **45.9** | **27.7** |
| Purchases [a] | 34.1 | 29.0 | 44.4 | 33.4 | 44.3 | 28.2 | 39.8 | 21.0 |
| Home production [b] | 16.8 | 35.2 | 20.8 | 11.1 | 5.3 | 2.2 | 6.1 | 6.7 |
| **Non-food items:** | **28.7** | **19.4** | **28.0** | **22.5** | **29.1** | **45.1** | **45.8** | **32.0** |
| Education | 2.5 | 3.4 | N/a | 2.4 | 8.2 | 3.2 | 7.8 | 6.4 |
| Health | 5.7 | 3.2 | N/a | 1.0 | . | 1.7 | 0.9 | 4.5 |
| Other non-foods | 20.5 | 12.8 | N/a | 19.1 | 20.9 | 40.2 | 37.1 | 21.1 |
| **Consumer Durables** | **12.7** | **1.4** | **2.2** | **3.5** | **5.2** | **.** | **5.4** | **.** |
| **Housing** | **7.7** | **15.1** | **2.5** | **29.6** | **16.0** | **24.5** | **2.8** | **40.2** |
| Rent | 5.9 | 12.6 | 1.7 | 17.6 | 12.1 | 15.6 | 2.1 | 31.4 |
| Utilities | 1.8 | 2.5 | 0.8 | 11.9 | 3.9 | 8.9 | 0.7 | 8.8 |
| **OVERALL** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |
| **GNP per capita ($)** [c] | **170** | **210** | **390** | **550** | **1,280** | **2,980** | **3,080** | **4,400** |

a Includes meals taken away from the home.
b Includes also food received from other household members, friends, and in the form of in-kind payments.
c GNP per capita is taken from international statistics for the same year of the survey, except for Panama where the latest available estimate is for 1996.

In general, as we would expect from Engel's law, the share of food items in the total tends to be relatively more important the lower the level of income in the country. The share of home-production in the food consumption aggregate tends to be higher in countries where relatively fewer transactions take place through the market place (Nepal, Vietnam) compared to those countries where agricultural markets are relatively well-developed (Ecuador, Panama, South Africa).

The share of consumption attributable to education and health also depends on the level of income of the country, as well as the extent to which these services are purchased through the market, or else are provided instead by the state at subsidized rates. A more detailed discussion of each of the main classes in the overall consumption aggregate is taken up in the sections that follow:

### 3.2 FOOD CONSUMPTION:

In principle, constructing a food consumption sub-aggregate is a straightforward aggregation exercise; all that is needed are data on the total value of the various food consumed in the reference period, or else on the total quantities of different food items consumed as well as a reference set of prices at which to value them. In practice, however, households consume food obtained from a variety of different sources, and so in computing a measure of total food consumption to include as part of the aggregate welfare measure, it is important to include food consumed by the household from *all* possible sources. In particular, this measure should include not just (i) food purchased in the market place, including meals purchased away from home for consumption at or away from home, but also (ii) food that is home-produced, (iii) food items received as gifts or remittances from other households, as well as (iv) food received from employers as payment in-kind for services rendered. In some cases where food can be and is stored over long periods of time, and where the questionnaire permits it, "food consumed" can be distinguished from "food purchased". In principle, it is the value of the former that should go into the consumption aggregate. A household that stocks up on cereals once every few months, and whose purchase is caught by the survey, should not be thereby counted as well-off, nor should someone who did not stock up in the survey period be counted as poor.

The food consumption module of most LSMS questionnaires typically contains separate sets of questions on (a) purchased and (b) non-purchased food items. As can be seen from Table 3.1, the relative importance of these two components in the food consumption sub-aggregate varies considerably by country: in Nepal, home-produced food items constitute more than half of food consumption, while in South Africa they comprise less than 10 per cent of food consumption. It is even more obvious that the extent of non-purchased food varies within countries, particularly between rural and urban sectors, but also within rural areas according to the level of living. As a result, failure to capture the value of consumption from home-production is likely to overstate both poverty and inequality.

The food purchases module in LSMS questionnaires typically contains questions on purchases of a fairly comprehensive list of food items (a) during a relatively short reference period, such as the last two weeks, and / or (b) during a typical month in which such purchases were made. Data are often collected on the total amount spent on purchasing each food item, and sometimes also on the quantities purchased, during the specified reference period. Calculating the food purchases sub-aggregate involves converting all reported expenditures on food items to a uniform reference period—say one year—and then aggregating these expenditures across all food items purchased by the household.

In surveys where information on food purchases has been collected for more than one recall period, the question arises as to which of the two sources of information should be used. Note once again that, in these guidelines, we are not concerned with *how* the data should be collected and what reference periods *should* be used, but rather with the decisions that must be made by an analyst who is confronted with multiple measures in an already collected survey. Consumption surveys—including LSMS surveys—have used several different designs in collecting consumption data, from a single question about purchases over the last two weeks, to multiple visits each with much shorter recall periods, to repeated visits over the year designed to capture seasonal variations in consumption patterns. There is large (but far from decisive) literature on the benefits and costs of these different designs, much of which is reviewed in the context of LSMS surveys in Deaton and Grosh (1998). If any given survey has collected data in more than one way, so that there is a choice, analysts should choose the alternative that is likely to provide the most accurate estimate of annual consumption for each household, not for households on average. In perhaps the ideal (but most expensive) case, where in each "season" the household has been visited on several occasions, estimates should be made of consumption in each of the seasons, and the seasonal totals added to get annual consumption. In most surveys, this will not be an option, and in many actual LSMS surveys, there is either no choice or choice is limited to either a "last two weeks" (or shorter period) measure, and a "usual month" measure. The literature reviewed in Deaton and Grosh leads to a recommendation in favor of the latter over the former, at least for the present purpose. The former tends to be biased by progressive forgetting, as well as the occasional intrusion of (especially well-remembered) purchases from outside the period. The latter has the advantage of being closer to the concept that we want—usual consumption is a better welfare measure than what actually happened in the last two weeks, which could have been unusual for any number of reasons—and reduces problems with seasonality, but will suffer from measurement error if respondents find it difficult to calculate a reasonable answer. In any case, and whenever possible, data from very short reference periods should be avoided. Over a period of a day or two, purchases are quite unrepresentative of consumption. Averaged over a large number of households, mean purchases will still be accurate for mean consumption, but dispersion will be exaggerated, with consequent exaggeration of inequality and (in normal cases) poverty. Consumption measures based on very short recall are not suitable for the construction of consumption aggregates for welfare purposes.

The total value of meals consumed outside the household (restaurants, prepared foods purchased from the market place) should also be included in the food consumption aggregate, as should the value of meals taken by household members at school, work, during vacations, etc. Almost all LSMS surveys ask explicitly about the total value of meals taken outside the home by all household members; this amount should also be included in the food consumption aggregate. In some cases, however, it is impossible to disentangle expenditure on some meals taken outside the home from other related (and more aggregate) non-food expenditures such as miscellaneous schooling expenses, total expenditure on vacations, etc. reported elsewhere in the questionnaire. This need not be cause for concern as long as these expenditures are included in the overall aggregate household consumption measure in one form or the other.

Almost all LSMS questionnaires contain a separate set of questions or module on consumption of home-produced food items. Here it is more common to find questions only on the amount of home-produced food items consumed in a typical month (rather than in the past 2 weeks), as well as the number of months each food item is typically consumed in a year. Data are often collected on both the total value and quantity of consumption of each home-produced food item. The home-production food sub-aggregate can thus be calculated by adding the reported value of consumption of each of the home-produced food items in a manner analogous to that followed in the case of food purchases.

In principle, it is possible to calculate the food home-production sub-aggregate using data on reported quantities consumed in conjunction with prices from the food purchases section. However, as pointed out in section 2.8 above, and to the extent possible, “farm-gate” prices should be used when imputing values to home-produced food items. Moreover, home-produced food items consumed by the household may not be comparable in quality to items traded in the market place. Households’ own valuation of the amount they would expect to receive (pay) if they had sold (bought) the home-produced food items that they consume are therefore likely to be a much better approximation to their true “farm-gate” value, rather than estimates derived using prevailing market prices from the food purchases section.

In most LSMS questionnaires, food received as payment in-kind, as well as in the form of gifts, remittances, etc., are usually lumped together into one set of questions (usually on total value of consumption from this source), or are subsumed under the questions on home production. Consumption of food derived from these sources should be added to the overall food aggregate, if it is not already implicitly included in the home-produced food sub-aggregate described above.

In some cases, however, it may be that questions on consumption of home-produced food items are not included in the questionnaires explicitly, so that data are available for consumption of purchased food items only. In such cases, it may still be possible to use data from the agriculture section to derive an estimate of the total value of home-produced food items. The section on crop production of most LSMS surveys typically includes a question of the type: “How much of ..[crop].. did your household keep for consumption at home?” as well as questions on dairy and other livestock products that the household consumed from its own production, so this information, in conjunction with data on prices, can be used to calculate the total value of home-produced food consumption.

For instance, in the case of the 1996 Kyrgyz Republic LSMS, consumption of home-produced crops and animal products was calculated from the "Agro-Pastoral Activities" section of the questionnaire, because the section on "Food Expenditure and Consumption" collected data on food purchases only. Exclusion of these items from the food consumption aggregate would have resulted in underestimating average food consumption by 30 per cent. Furthermore, because the share of home-produced food in rural areas was much higher than in urban areas, excluding it from the aggregate consumption measure would have resulted in seriously under-estimating the welfare of rural compared to urban households.

Because all LSMS surveys collect information on total value of the food item consumed (for both purchased and non-purchased foods), the question of assigning monetary values does not arise. However, in surveys where data are collected on both value as well as quantity of food item consumed, it may be that due to interviewer error—or a variety of other reasons—we find households consuming non-zero quantities of a particular item, but where data on the total value of consumption may be missing. In such instances, the question arises as to what prices to use to value food consumption of these items – (i) average or median prices calculated from the survey data for other households, (ii) prices from the price (community) questionnaire, or else (iii) prices from some other external source?

Faced with a choice of prices, the best choice is usually the one that offers the closest approximation to the amount actually paid. Except where there is a large choice of quality, the values reported by the household are likely to be better guide than market prices, if only because they record actual, not hypothetical transactions. When such data are not available, the analyst can construct prices from the data for other households, and use the median (in preference to the mean, which is more sensitive to outliers) price paid by other households in the same cluster. When these data are not available, there is no choice but to use prices reported by other households in the same sub-region, district, division, or province, depending on whichever is the next higher level of aggregation for which price information is available. When making such substitutions, great care must be exercised, particularly through checking that the prices being imputed are reasonable. Mechanical imputation can result in the matching of prices for goods that are in fact very different, with catastrophic consequences for consumption aggregates. In one famous example, a survey imputed a value for water collected by households from local wells by using the geographically nearest price for purchased water, which in this case turned out to be imported bottled water from a French spa. By this remarkable imputation, rural households were given living standards well in excess of their urban counterparts.

### 3.3: CONSUMPTION OF NON-FOOD ITEMS:

LSMS questionnaires typically collect information on consumption of a wide range of non-food items. For example, data are collected on consumption of daily-use items such as soap and cleaning supplies, kerosene and petrol, newspapers, tobacco, stationary and supplies, recreational expenses and miscellaneous personal care items, as well as other less frequently purchased items such as clothing, footwear, kitchen equipment, household textiles such as sheets, curtains, bedcovers, etc., and other household use items. Data are also collected on education and health expenditures for all household members. Expenditures on household utilities are typically collected in the housing module, and for households that have small business enterprises, that module can provide information on non-food items that were produced for home consumption. Finally, these questionnaires typically also solicit information on other infrequent expenses such as legal fees and expenses, home repair and improvements, taxes and levies, as well as expenditure on social ceremonies, marriages, births, and funerals, etc.

The actual computation of an annual non-food consumption aggregate is straightforward. The difficulties lie in the choice of which items to include. The choice depends not only on which data are available, but also on the analytic objectives of the study being undertaken. However, there are a few general issues that apply to most LSMS survey data and for the standard welfare analyses; these are taken up later in this section.

Unlike many homogeneous food items, most non-food goods are too heterogeneous to permit the collection of information on quantities consumed—exceptions are some fuels, like kerosene or electricity, and some transportation items—so that LSMS surveys collect data only on the value of non-foods purchased over the reference period. Data on purchases of non food items are often collected for different recall periods, for example over the past 30 days, the past 3 months, or the past 12 months, depending on how frequently the items concerned are typically purchased. Constructing the non-food aggregate thus entails converting all these reported amounts to a uniform reference period—say one year—, and then aggregating across the various items.

As far as singling out which non-food “expenditures” should be excluded from the consumption aggregates, some choices are straightforward. Expenditures on taxes and levies are not part of consumption, but a deduction from income, and should not be included in the consumption total. An apparent exception can sometimes be argued for some local taxes, such as property taxes, that are used to provide local services, such as schools, policing, or garbage collection. In some locations, these taxes bear no relation to services provided and so should not be included in the consumption aggregate. But where such taxes are closely related to services provided, households that are paying more tax are receiving more services, are better off as a result, and the inclusion of the tax will do something to capture the regional differences in public good provision between different households. Commodity taxes are included in the prices of goods, and so (correctly) find their way into the consumption aggregate through the prices—though it is also possible to imagine using reference prices for money metric utility that exclude commodity taxes. In any case, no special treatment is required for commodity taxes. As we have already argued, expenditure on "regrettable necessities", such as travel to work or work-related clothing, are best included, though business expenses associated with the operation of own-account business must be excluded. These distinctions are much more easily enunciated than implemented; the welfare analyst faces much the same difficulties as does a tax inspector! Some surveys list as "expenditures" items that are clearly capital account transactions, such as expenditures for a "saving club". All purchases of financial assets, as well as repayments of debt, and interest payments should be excluded from the consumption aggregate.

More complex is the case of "lumpy" and relatively infrequent expenditures such as marriages and dowries, births, and funerals. While almost all households incur relatively large expenditures on these at some stage, only a relatively small proportion of households are likely to make such expenditures during the reference period typically covered by the survey. For instance, in the case of the LSMS survey conducted in Pakistan (1991 PIHS), less than 8 per cent of households reported having made a dowry payment during the past 12 months; however, such expenses constituted 20 per cent of their total annual consumption, Howes and Zaidi (1994). Ideally, we would want to "smooth" these lumpy expenditures, spreading them over several years, but lacking the information to do so—which might come, for example, by incorporating multi-year reference periods for such items—we recommend leaving them out of the consumption aggregate. Note the analogy with measurement error. Although transitory expenditures are real enough, consumption aggregates that include them can be thought of as "noisy" measures of the longer-run averaged totals that we would really like to measure. In this sense, measurement error and lumpiness can be thought of together, and the techniques we discuss in Section 6.4 below can be applied to both.

Expenditure on health is an often lumpy expenditure where a decision almost always has to be made. One argument for exclusion is that such expenditure reflects a regrettable necessity that does nothing to increase welfare. By including health expenditures for someone who has fallen sick, we register an increase in welfare when, in fact, the opposite has occurred. The fundamental problem here is our inability to measure the loss of welfare associated with being sick, and which is (presumably) ameliorated to some extent by health expenditures. Including the latter without allowing for the former is clearly incorrect, though excluding health expenditures altogether means that we miss the difference between two people, both of whom are sick, but only one of which pays for treatment. It is also true that some health expenditures—for example cosmetic expenditures—are discretionary and welfare enhancing, and that it is difficult to separate "necessary" from "unnecessary" expenditures, even if we could agree on which is which. It is also difficult without special health questionnaires to get at the whole picture of health financing. Some people have insurance, so that expenditures are only "out of pocket" expenditures which may be only a small fraction of the total, while others have none, and may bear the whole cost. Simply adding up expenditures will not give the right answer. Yet another approach is a pragmatic one that recognizes that measured health expenditures are a noisy approximation to what we would ideally like to have. As we shall see in Section 6.3 below, the decision about whether to include them in the total depends, not only on the extent of the measurement error, but also on elasticity of health expenditures with respect to total expenditure. The higher the elasticity, the stronger the case for inclusion.

**Table 3. 2: Elasticity of Health and Education Expenditures**

| Country | Year | Health Expenditures | | | Education Expenditures | | |
|---|---|---|---|---|---|---|---|
| | | Estim. elasticity | t-statistic | R squared | Estim. elasticity | t-statistic | R squared |
| Vietnam | 92-93 | 0.86 | 33.2 | 0.19 | 1.35 | 46.8 | 0.43 |
| Nepal | 1996 | 0.75 | 20.9 | 0.15 | 1.65 | 43.5 | 0.48 |
| Kyrgyz Republic | 1996 | 0.74 | 14.3 | 0.14 | 0.68 | 13.1 | 0.13 |
| Ecuador | 94-95 | -- | -- | -- | 1.38 | 46.6 | 0.37 |
| South Africa | 1993 | 1.14 | 58.7 | 0.40 | 1.32 | 67.2 | 0.45 |
| Panama | 1997 | 0.80 | 29.2 | 0.25 | 1.24 | 54.9 | 0.49 |
| Brazil | 96-97 | 0.85 | 31.0 | 0.26 | 1.25 | 47.9 | 0.45 |

The elasticity of expenditure on health was estimated from the LSMS data from the seven countries reviewed for this paper. With the exception of South Africa, the elasticities of health expenditures are estimated to be relatively low (see Table 3.2), a result that should be contrasted with the estimated elasticities for educational expenditures, which are also shown in the table. Given these numbers, and given the measurement problems, we think that there is a relatively good case for excluding health expenditures in the consumption aggregate.

Table 3.2 also shows elasticities for educational expenditures, for which similar issues arise as for health. Although educational expenses are not as irregular as health expenditures, they are located at a particular point in the life-cycle, so that, even if all households paid the same for education and had the same number of children, some would appear better-off than others simply by virtue of their age. In this sense, educational expenditures, like health expenditures, would ideally be smoothed over life. There is also the argument that education is an investment, not consumption, and should be included in saving, not in the consumption aggregate. But we follow standard national income accounting practice and recommend that it be included in the consumption aggregate.

Another important group of items to consider are items such as consumer durables and housing whose useful life typically spans a time-period greater than the interval for which the consumption aggregate is being constructed. As discussed in Section 2.4 above, the relevant component of the total is not the expenditure on such items but a measure of the flow of services that they yield. How to calculate this measure of "user-cost" for consumer durables and for housing is taken up in more detail in Sections 3.4 and 3.5 respectively.

Another group of expenditures are gifts, charitable contributions, and remittances to other households. A case can be made for including gifts to others based on the fact that they must yield as much welfare to the transmitting household as do other consumption expenditures that could have been made with the funds. However, their inclusion in the consumption aggregate would involve double-counting if, as one would expect, the transfers show up in the consumption of other households. Average living standards could be increased without limit if each household were simply encouraged to donate its income to another household, and so on; nothing would have changed except our measure of welfare. We therefore recommend excluding gifts and transfers, counting them as they are spent by their recipients.

Finally, there are various miscellaneous non-food items that are worth mentioning. Expenditures at weddings and funerals are another lumpy and occasional item. In some countries, these expenditures are really transfers—to the bride and groom, or to their parents—and should probably be treated as such and excluded from the aggregate. Their transitoriness would lead to the same conclusion. Some households own small enterprises which produce goods for own-consumption; such items should be treated analogously to home-produced food, priced as well as is possible in the circumstances, and added to the total. There are also a number of non-foods received as payment in kind; housing subsidies, transport to work, and education are probably the most important examples. In principle, all such items should be valued and included though, as always, thought should be given to the tradeoff between comprehensiveness on the one hand, and measurement error on the other, again see Section 6 below. Expenditures on utilities, water, gas, electricity, or telephone can also be problematic if some households are subsidized and some are not. For example, some households may receive high quality piped water at little or no cost, while others have to buy expensive, inconvenient, and lower quality water from local vendors. In some cases, making accurate regional (and certainly international) welfare comparisons will make it necessary to make corrections to (by repricing) the reported expenditures.

### 3.4 CONSUMER DURABLES:

From the point of view of household welfare, rather than using expenditure on purchase of durable goods during the recall period, the appropriate measure of consumption of durable goods is the *value of services* that the household receives from all the durable goods in its possession over the relevant time period. As discussed earlier in Section 2.5, the "user cost" or "rental equivalent" for durable goods is approximately:

$$S_t\, p_t ( r_t - \pi_t + \delta ) \tag{3.1}$$

where $S_t\, p_t$ is the current value of the durable good, $r_t - \pi_t$ the real rate of interest, and $\delta$ the rate of depreciation for the durable good. Although in theory, $r_t$ is the general nominal rate at time *t*, and $\pi_t$ is the specific rate of inflation for each durable good at time *t*, in practice it is best to collapse the two into a single real rate of interest, taken as an average over several years, and to use that real rate for all durable goods.

Almost all LSMS surveys collect data on the stock of durable goods currently owned by the household. However, the amount of detailed information collected about each durable good varies quite considerably across surveys. Therefore, depending on the type of data available, the analyst must choose between a number of different strategies when using (3.1) to estimate the durable goods consumption sub-aggregate.

In the case of the Vietnam and Nepal LSMS surveys, the "Inventory of Durable Goods" module of the questionnaire collected information on (i) the current value of each durable good ($S_t\, p_t$), (ii) the age of the item $T$ in years, as well as (iii) the value of the item when purchased ($S_t\, p_{t-T}$). Using (3.1), consumption of durable goods was then calculated as follows:

First the depreciation rate $\delta$ for each type of durable good was calculated using:

$$\delta - \pi = 1 - \left( \frac{p_t}{p_{t-T}} \right)^{1/T} \tag{3.2}$$

For instance, estimates of $\delta - \pi$ calculated from the survey data in Nepal ranged from 13 per cent for television sets, 17 per cent for radio-cassette players and electric fans, to 22 per cent for bicycles. These estimates were then used, in conjunction with data on the real rate of interest $r_t$ - $\pi_t$ and the current value of durable goods owned by each household $S_t\, p_t$, to calculate the durable goods consumption sub-aggregate. In order to minimize the influence of any outliers in the data, the median value of depreciation rates were used for each of the 16 items for which data were collected (i.e. rather than using household-specific values of $\delta$ s calculated from the data).

In the case of the Ecuador and Panama data sets, information was available only on (i) current value of durable goods owned by the household $S_t\, p_t$ as well as (ii) the age of the item $T$ in years. As the value of the item when new was not available in the data sets (i.e. $S_t\, p_{t-T}$), (3.2) could not be used to calculate the $\delta$ s; instead, an estimate of consumption of durable goods was calculated as follows:

First, the average age for each durable good, $\overline{T}$, is calculated from the data on the purchase dates of the goods recorded in the survey. We then estimate the average lifetime of each durable good as $2\overline{T}$ under the assumption that purchases are uniformly distributed through time. (In some cases, for example where a good has only recently been introduced, some other guess would have to be made.) The remaining life of each good is then calculated as $2\overline{T}$ - $T$; in this case, and somewhat arbitrarily, this estimate is "rounded up" to 2 years when the estimate was less. A rough estimate of the flow of services is then derived by dividing the current replacement value $S_t\, p_t$ by its expected remaining life. For the countries, the interest component in the flow of services was ignored.

Taking logs and rearranging the terms somewhat, (3.2) can be rewritten as:

$$\ln(p_t) = \ln(p_{t-T}) - T\ln(1 - \delta + \pi) \tag{3.3}$$

thus, in cases where data are available on the current value and age of the durable good only, using (3.3) $\delta - \pi$ can be estimated by regressing the current value of the durable good on a constant and $T$ (i.e. by assuming that the current value of the durable good when new is a constant).

In the LSMS survey for the Kyrgyz Republic, data were available only on the total current value of the stock of durable goods owned by each household. In this case, (3.1) was estimated directly assuming a value of 10 per cent for ($r_t$ - $\pi_t + \delta$), a number that seemed reasonable given the prevailing real rate of interest and plausible values of $\delta$. Finally, in the case of the Brazil and South Africa data sets, consumption of durable goods was not included in the overall consumption aggregate because of unavailability of data. Whenever good data are available on the total stock of durable goods owned by the household, we would recommend incorporating in the overall consumption aggregate a measure of the flow of services accruing to the household from these goods.

### 3.5: HOUSING:

Of all components of the household consumption aggregate, the housing sub-aggregate is often one of the most problematic. The underlying principle is the same as for other consumer durables; what is required is a measure in monetary terms of the flow of services that the household receives from occupying its dwelling. Because house purchase is such a large and relatively rare expenditure, under no circumstances should expenditures for purchase be included in the consumption aggregate. In the hypothetical case where rental markets function perfectly and all households rent their dwellings, the rent paid is the obvious choice to include in the consumption aggregate. Whenever such rental data are available, and provided the rents are a reasonable reflection of fair market value, they should be used for constructing the housing sub-aggregate and the consumption total.

In many cases, however, households own the dwelling in which they reside and do not pay rent as such. Others are provided with housing free of charge (or at subsidized rates) by their employer, a friend, a relative, government, or other such entities. In many LSMS surveys, non-renter households are asked how much it would cost them if they had to rent the dwelling in which they reside, and this “implicit rental value” can be used in place of actual rent. Such measures must be treated with caution and carefully inspected prior to use. Implicit rent is a hypothetical concept, perhaps to the interviewer as well as to the respondent, and the numbers reported may not always be credible or usable. Even when people are apparently confident about their estimates, they may do a very poor job of reporting market rents. Rents known to them may be subsidized, out of date, or in some way unrepresentative of the general run of property in their area.

The hardest cases arise when there are data on neither actual nor imputed rent. In the case of the South African LSMS, in addition to information on rents, data were collected on the total property value (i.e. current sale value) of the dwelling. For households who reported property values but neither actual nor imputed rents, the local median of the ratio of rental to property value was used to calculate an imputed rental. In cases where the property value of the dwelling was also missing, a median property value per room was used in each locality to assign a property value to the dwelling based on the total number of rooms, and the estimated property value used to estimate its rental value.

In the Nepal and Kyrgyz Republic LSMS data sets, hedonic housing regressions were used to impute a value of housing consumption wherever information on rents was missing. The idea behind this approach is to estimate an econometric model in which rents reported by a subset of the population (either actual or reported, as the case may be) are regressed on a set of housing characteristics including, for instance, the number of rooms and measures of quality of the dwelling such as type of roof, floors, construction material of walls, type of sanitation, etc. as well as regional dummies. The parameter estimates obtained from this model are then used to calculate rents for that segment of the population for which data on rents are missing.

In cases where data on imputed rental value for non-renting households are not available, or where such estimates are deemed to be unreliable or difficult to estimate because rental markets are thin (as is the case, for instance, in rural areas in some countries), the hedonic regression approach can also be used to impute rents for such households. The regression model is first estimated using rent paid by renter-households as the dependent variable; the results of the model are then used to impute rents for the rest of the population. Because there may be systematic differences in characteristics between renters and non-renter households, the Heckman (1976) two-stage estimation method is also sometimes used when estimating such hedonic models, see for example Lee and Trost (1978) and Malpezzi and Mayo (1985).

Finally, in cases where data on rental value are not available for both renters as well as non-renters, or where the percentage of the population renting their dwelling unit is so small as to make estimation of a hedonic housing model unfeasible, data on property values can be used to estimate the value of housing consumption. Following an approach similar to that used for consumer durables outlined earlier in Section 3.4, the value of the flow of services received by the household from housing can be calculated by using an appropriate guesstimate of the user cost per unit to derive a measure of housing consumption from the total property or "stock value" of the dwelling. This was the approach used in the case of the Vietnam LSMS data set.

Once again, it is necessary to warn against the mechanical application of these (and other related) procedures. In some countries, housing and rental markets are not well enough developed to permit any serious estimate of rental value, and attempts to repair the deficiency using data from a small number of households are unlikely to be effective, however sophisticated the econometric technique. Even if there is information on rents in some parts of the country, it is obviously hazardous to apply it to other areas, and econometric fixes sometimes do no more than disguise the problem. In extreme cases, the best available solution may simply be to exclude the housing component for all households.

Note finally that data related to expenditures on water, electricity, garbage collection, and other such utilities and amenities are usually collected in the housing module of LSMS questionnaires. They should also be included in the housing sub-aggregate, and in the measure of total expenditure.

**Box 2. Recommendations for Constructing the Consumption Aggregate**

**Food Consumption**

Food purchased from market: amount spent in the typical month x 12 (or number of months typically consumed)
Food that is home-produced: quantity in typical month x farmgate price x number of months typically consumed
Food received as gift or in-kind payment: total value for a year
Meals consumed outside the home:

- Amount spent in restaurants
- Amount spent on prepared foods
- Amount spent on meals at work [here or in work-related expenditures]
- Amount spent on meals at school [here or in education expenditures]
- Amount spent on meals on vacation [here or in vacation expenditures]

Issues: Missing prices or unit values, first choice is price (unit value) reported by the household; if not available, use as a proxy the median – not mean – price paid by 'similar' households in the neighborhood, subject to checks that such prices are plausible. Check data for outliers; miscoding or misunderstanding of units for quantities causes errors in unit values.

**Non-Food Consumption**

Daily use items, annualize the value
Clothing and housewares, annualize the value
Health expenses should only be included if they have high income elasticity in relation to their transitory variance or measurement error
Education expenses: Typically measured quite accurately in most surveys -- our recommendation is to include them
Work-related expenses: To the extent possible, purely work-related expenditures should be excluded. This recommendation does not include transport to work or work clothing.
Exclude taxes paid, purchase of assets, repayment of loans, expenditure on durable goods and housing, as well as other lumpy expenditures such as marriages and dowries. To the extent that local property taxes bear a relation to services rendered, we recommend their inclusion.

**Durable Goods**

Calculate an annual rental equivalent using an appropriate real rate of interest and median depreciation values for each item calculated across all households owning that item.

**Housing**

If a household pays rent, annualize the amount of rent paid. Even if the dwelling is owned by the household or received free of charge, an estimate of the annual rental equivalent must be included in the consumption aggregate. In countries where few households pay rent, rental equivalents are potentially inaccurate, and the benefits of completeness need to be weighted against the costs of error.

## 4. ADUSTING FOR COST OF LIVING DIFFERENCES:

### 4.1 INTRODUCTION:

In this Section, we lay out some of the practical issues involved in calculating the price indexes that are used to deflate the nominal consumption aggregate. As we saw in the theory section, the calculation of money metric utility requires that the nominal aggregate be deflated by a Paasche price index, in which the weights vary from household to household. If the analyst prefers to work with the welfare ratio approach to measurement, the deflator is a Laspeyres index whose weights are the same for all households. We present the price indexes in that order, which follows our recommendation in favor of the money metric approach. We note that these price indexes are of independent interest beyond their roles in deflating expenditures, simply for measuring prices.

Price indexes are used to aggregate a large number of individual prices into a single number, so that individual prices are the raw material for the indexes. In LSMS and other surveys, there are several possible sources for the prices, see Deaton and Grosh (1998) for further discussion of how prices can be collected and for an analysis of some of the differences between them. In brief, there are three possible sources. The first source is the survey itself, and the reports of purchases by the households surveyed. In many (but not all) surveys, households report both quantities and expenditures for most of the foods they purchase (three kilos of rice for 5 rupees) as well as for a few non-food items where quantities are well-defined, fuels being the obvious example. Dividing expenditures by quantities gives “unit values”. These are affected by quality choices; someone who buys better cuts of meat will pay more per unit, but experience shows that the spatial variation of unit values is closely related to price variation. As a result, unit values provide good price information, especially when averaged over households in a cluster.

The second source of price information is a dedicated price questionnaire, often administered in each cluster as part of a community questionnaire. The price questionnaire seeks to measure prices in the markets actually patronized by survey households and in principle, provides a direct measure of what we need. In practice, there may be some compromise of data quality from the fact that the investigators do not actually make purchases. There are also sometimes problems of locating a wide enough range of homogeneous goods in all the relevant markets, so that it may be hard to match prices from the questionnaire with the expenditure patterns of the households in the survey. But this is the preferred source of price information when quantities are not collected from each household, and the only source for those goods, such as most non-food items, and food eaten away from home, where quantity observation is not possible in principle.

The third source of price data is ancillary data, for example from government price surveys. This is typically a source of last resort. Such data are often thin on the ground, and there will often be many households whose nearest observed price is so far away as to be irrelevant. Nevertheless, such data are sometimes the only information available, and it is usually better to use them than to make no correction at all.

Note finally that the situation is somewhat different depending on whether we need to compute price indexes over space or over time. In the latter case, for example when we are comparing two surveys for the same country some years apart, there will usually be available some national consumer price index that tells us by how much the general price level has changed between the two surveys. In the absence of spatial data on prices, the temporal index should be used to deflate all nominal expenditures to ensure that welfare comparisons between the two periods are not being driven by inflation.

Before turning to the details, it is useful to begin by recalling the formulas for money-metric and welfare-ratio utilities, whereby each is expressed as total expenditure deflated by a price index. For money metric utility, we have from (2.6) that

$$u_m^h \approx \frac{p^h \cdot q^h}{P_P^h} = \frac{x^h}{P_P^h} \tag{4.1}$$

where the Paasche price index in the denominator is given by

$$P_P^h = \frac{p^h \cdot q^h}{p^0 \cdot q^h} \tag{4.2}$$

Here, the weights for the price index are the quantities consumed by the household itself and therefore differ from one household to another. By contrast, welfare-ratio utility uses a Laspeyres index so that, from (2.10)

$$u_r^h = \frac{x^h}{P_{Lz}^h} \tag{4.3}$$

where, if we are using the poverty line as the base, the Laspeyres is given by (2.9)

$$P_{Lz} = \frac{p^h \cdot q^z}{p^0 \cdot q^z} = \sum_{i=1}^{n} w_i^{z0} \left( \frac{p_i^h}{p_i^0} \right) \tag{4.4}$$

Most of past practice has been based on using Laspeyres indexes for adjustment, though not always with weights tailored to the poverty line as in (4.4), and relatively little attention has been given to the calculation of the Paasche index. In this section, we focus on the calculation of (4.2) and (4.4) using the data from a typical LSMS survey.

### 4.2 PAASCHE PRICE INDEX:

It is useful to express (4.2) in a manner that makes it easier to see how the Paasche index could be calculated from the type of data typically collected in an LSMS survey. Equation (4.2) can also be rewritten in the form:

$$P_P^h = \left( \sum w_k^h ( p_k^0 / p_k^h ) \right)^{-1} \tag{4.5}$$

where $w_k^h$ is the share of household $h$'s budget devoted to good $k$. This formula can be calculated from expenditure data and price relatives alone. The following approximation may also be used:

$$\ln P_P^h \approx \sum w_k^h \ln \left( \frac{p_k^h}{p_k^0} \right) \tag{4.6}$$

Note that these indexes involve, not only the prices faced by household *h* in relation to the reference prices, but also household *h*'s expenditure pattern, something that is not true of a Laspeyres index. The distinction is an important one; to convert total expenditure into money metric utility, the price index must be tailored to the household's own demand pattern, a demand pattern that varies with the household's income, demographic composition, location, and other characteristics.

The reference price vector $p^0$ is inevitably selected as a matter of convenience, but should not be very different from prices actually observed. A good choice is to take the median of the prices observed from individual households (for foods and fuels, if unit values are collected) or from the community questionnaire (otherwise). Especially when using the unit values from individual records, there will be some outliers, not only for the usual reasons, but also because there are often misunderstandings about units—such as eggs being reported in dozens instead of in units. Use of medians rather than means reduces sensitivity to such accidents. The use of a national average price vector ensures that the money metric measures conform as closely as possible to national income accounting practice, as well as eliminating results that might depend on a price relative that occurs only rarely or in some particular area.

In general, even if quantities and unit values are available at the household level, this will only be the case for a limited set of goods, typically foods and perhaps some fuels. For nonfoods, and perhaps some foods, price relatives will come from community questionnaires or even other regional sources, and will not be available at the household level. In such cases, we must use the price relative that seems most appropriate for each household, in which case (4.6), for example, becomes

$$\ln P_P^h = \sum_{k \in F} w_k^h \ln ( p_k^h / p_k^0 ) + \sum_{k \in NF} w_k^h \ln ( p_k^c / p_k^0 ) \tag{4.7}$$

where $F$ denotes the set of goods (foods) for which we have individual household price relatives, and $NF$ is the set where we do not (nonfoods), and the superscript $c$ denotes a cluster or regional price. One further refinement is likely to be useful. Because the household level unit values are likely to be noisy, and to contain occasional outliers, it is wise to replace the individual $p_k^h$ by their medians over households in the same PSU or locality.

Analysts often want to use LSMS data for purposes other than deflating nominal consumption for each household, and calculate some indicator of regional price levels, or of regional price levels at different times through the survey year. This can be done using either the Paasche indexes of this subsection, or the Laspeyres indexes discussed below. The most straightforward procedure is simply to take means (or better, medians) within the relevant region or season of the individual Paasche indexes as calculated above. Such indexes could be made more relevant to the poor by averaging the individual household price indexes only over those at or below the poverty line, see the next subsection for discussion of procedures. Note that when all households within a region $R$ face the same prices, so that

$$\ln P_P^h = \Sigma\, w_k^h \ln ( p_k^R / p_k^0 ) \tag{4.8}$$

the average of the (log) prices is given by

$$\overline{\ln P_P}^R = \Sigma\, \overline{w_k}^R \ln ( p_k^R / p_k^0 ) \tag{4.9}$$

so that the appropriate weights for the average index are the means of the budget shares over all (or poor) households. Note that is not the same as using the weights defined as the share of aggregate purchases in aggregate total expenditure, weights that are typically used in computing consumer price indexes by statistical offices. These aggregate weights effectively weight each household, not on a "democratic" basis, with one household or individual getting equal weight, but on a "plutocratic" basis in which each household is weighted according to its total expenditure. Because better-off households have, by definition, larger total expenditures, the weights of plutocratic indexes are representative more of rich than of poor expenditure patterns, a bias that causes problems when relative prices change in a way that affects the poor and the rich differently. For example, if the relative price of a staple food rises, a plutocratic price index will rise by less than a democratic price index if the staple is a necessity, and the poverty-increasing effects of the price change will be understated.

### 4.3 CALCULATING LASPEYRES INDEX:

For researchers who wish to follow the welfare-ratio rather than money-metric approach to measuring living standards, the relevant price index is not the Paasche index (4.2), but the Laspeyres index (4.4). Because this index uses the same weights for all households, it is typically more straightforward to calculate than is the Paasche, though in both cases, the hardest task is finding the price relatives, not calculating the weights. Once again, it is often useful to write the Laspeyres in terms of budget shares and price relatives so that, corresponding to (4.5), we now have

$$P_L^h = \frac{p^h \cdot q^z}{p^0 \cdot q^z} = \Sigma \; w_k^{z0} \left( \frac{p_k^h}{p_k^0} \right) \tag{4.10}$$

which corresponds to (4.4) or, alternatively, corresponding to (4.6),

$$\ln P_L^h \approx \Sigma \; w_k^{z0} \; \ln \left( \frac{p_k^h}{p_k^0} \right) \tag{4.11}$$

The discussion of measuring price relatives for foods and non-foods, and of aggregation over households goes through as before, though when we average the Laspeyres indexes, only the price relatives are being averaged, not the weights, though the principle of averaging price indexes over households remains unchanged.

The welfare ratio approach requires comparison of actual indifference curves with a baseline indifference curve, here taken to be the poverty-line indifference curve, and the theory requires that the weights for the Laspeyres index used for deflation be calculated at that indifference curve. In practice, it may not be obvious how to do this. There are usually many households near the poverty line, though rarely many (or even any) *exactly* at it, so we lack the data for the quantity or budget share weights in (4.10) and (4.11). A useful solution to this problem is to calculate weights by averaging over the expenditure patterns of households near the poverty line, with those closer to it given more weight than those further away. Weights with this property are conveniently provided by a "kernel" function, here denoted $K_h(\,.\,)$ and the weights in (4.4), (4.10) or (4.11) are calculated from

$$\tilde{w}_k^{z0} = \sum_{h=1}^{H} K_\tau(x^h - z)\, w_k^h \tag{4.12}$$

This sum is a weighted average over *all* households in the sample of the budget shares $w_k^h$ using the kernel weights. There are a number of suitable choices for the kernel function which must be positive, must sum to one over all households, and which must be smaller the larger is the absolute difference between $x^h$ and the poverty line *z*. One convenient choice is the "bi-square" function

$$K_\tau(x - z) = \frac{1}{\tau}\left(1 - \left(\frac{x - z}{\tau}\right)^2\right)^2 \text{ for } \left|\frac{x - z}{\tau}\right| \leq 1 \tag{4.13}$$

and

$$K_\tau(x - z) = 0, \text{ otherwise.} \tag{4.14}$$

The number $\tau$ is a "bandwidth" that controls how many households are included in the sample. The larger is $\tau$, the more households are used, which makes the average more precise, but can cause bias by including households a long way from the poverty line. In practice, setting $\tau$ so as to include a few hundred households around the poverty line will usually be satisfactory. These equations are also likely to work better if $x^h$ and *z* in (4.12) to (4.14) are replaced by their logarithms, so that distances from the poverty line are measured proportionately, not absolutely.

Note finally, that although different price indexes will sometimes be similar, it is dangerous to assume that this will always be true. Because of poorly developed infrastructure, relative prices sometimes vary a good deal from one place to another, and when this is the case, price indexes are sensitive to the weights used to construct them. Note again that the weights for the Paasche indexes are household specific weights, so that because household level demand patterns are quite variable, the (appropriate) deflation of total expenditure by the household level Paasche index will generally give different money metric utility rankings than will (the inappropriate) deflation by local (e.g. Laspeyres) indexes that do not vary from household to household. Even when price data are sparse, and only available for a few regions, it is still desirable to calculate the household-specific indexes, not because prices vary from one household to another within the same region, but because the weights do.

Our recommendation here follows from our original recommendation for the use of money metric utility. Money metric utility is calculated by deflating nominal consumption expenditures by the Paasche index (4.5) and (4.6), and that is what we recommend using . Calculation of the Laspeyres index might be marginally more convenient—though given the other household specific calculations, constructing household specific price indexes should pose no additional computational burden.

## 5. ADUSTING FOR HOUSEHOLD COMPOSITION:

### 5.1 INTRODUCTION:

Sections 3 and 4 have presented guidelines on how to use LSMS data to construct a nominal measure of total household consumption and of how to adjust it to take into account cost-of-living differences. However, we are ultimately interested in *individual* welfare, not the welfare of a household, something that is hard to define in any very useful way. If it were possible to gather data on consumption by individual family members, we could move directly from the data to individual welfare, but except for a few goods, such data are not available, even conceptually—think of public goods that are shared by all household members. As it is, the best that can be done is to adjust total household expenditure by some measure of the number of people in the household, and to assign the resulting welfare measure to each household member as an individual.

Equivalence scales are the deflators that are used to convert household real expenditures into money metric utility measures of individual welfare. If a household consists entirely of adults, and if they share nothing, each consuming individually, then the obvious equivalence scale would be household size, which is the number of people over which household expenditures are spread. Even when households consist of adults and children, welfare is often assessed by dividing expenditures by household size, as a rough-and-ready concession to differences in family size. However, such a correction does not allow for the fact that children typically consume less than adults, so that deflating by household size will understate the welfare of people who live in households with a high fraction of children.

Moreover, simply deflating household expenditures by total household size also means implicitly ignoring any economies of scale in consumption within the household. Some goods and services consumed by the household have a “public goods” aspect to them, whereby consumption by any one member of the household does not necessarily reduce the amount available for consumption by another person within the same household. Housing is an important household public goods, at least up to some limit, as are durable items like televisions, or even bicycles or cars, which can be shared by several household members at different times. Because people can share some goods and services, the cost of being equally well-off does not rise in proportion to the number of the people in the household. Per capita measures of expenditure thus understate the welfare of big households relative to the living standards of small households.

In this Section we discuss equivalence scales in general and outline some of the main approaches to their calculation. But before doing so, it is worth emphasizing that we do *not* recommend abandoning the use of per capita expenditure. Twenty years ago, per capita expenditure was itself something of an innovation, and many studies worked with total household expenditure or income without correction for household size. In the years since, deflation to a per capita basis has become the standard procedure, and although its deficiencies are widely understood, none of the alternatives discussed have been able to command universal assent. As a result, no calculation of welfare or poverty profile should ever be done without the calculation of per capita expenditure as at least one of the alternatives. In part, this recommendation reflects the burden of the past; results are almost always compared with previous analyses for the same country, or with similar analyses for other countries which use per capita expenditure. But it is also true that 20 years of experience with per capita expenditure has given analysts a good working understanding of its strengths and weaknesses, when it is sound (in most cases), and when it is likely to be misleading (for example, in comparisons of the average living standards of children and the elderly.)

### 5.2 EQUIVALENCE SCALES:

To make welfare comparisons across households with different size and demographic composition, we need some way of adjusting aggregate consumption measures to make them comparable across households. In this regard, just as a price index is used in order to make comparable consumption levels of households with different cost-of-living, equivalence scales are a way to make comparable consumption aggregates of households with different demographic composition. While many different methods have been proposed in the literature to calculate the exact conversion factors used in each particular set of equivalence scales, the underlying principle is often the same: the basic idea is that various members of a household have "differing needs" based on their age, sex, and other such demographic characteristics, and that these differing needs should be taken into account when making welfare comparisons across households.

The costs of children relative to adults and the extent of economies of scale are of the first-order of importance for poverty and welfare calculations. Indeed, the direction of policy can sometimes depend on exactly how equivalence scales are defined. Larger households typically have lower per capita expenditure levels than small households but until we know the extent of economies of scale, we do not know which group is better off, or whether anti-poverty programs should be targeted to one or the other. Rural households are often larger than urban households, and we are sometimes unable to compare rural with urban poverty without an accurate estimate of the extent of economies of scale. Another frequent comparison is between children and the elderly, and both groups have claims for public attention on grounds of poverty. Children tend to live in larger households than do the elderly, and (obviously) live in households with a higher fraction of children. As a result, comparisons of welfare levels between the two groups are often sensitive to what is assumed about both child costs and about economies of scale, see the calculations in Section 6 below. Issues involving comparison between children and the elderly have acquired a new salience in work on the transition economies of Eastern Europe which, compared with developing countries of Africa or Asia, have relatively large elderly populations which receive state support through pensions and health subsidies. As a result, the two groups are in competition for welfare support, and an accurate assessment of their relative poverty has become an important issue.

Unfortunately, there are no generally accepted methods for calculating equivalence scales, either for the relative costs of children, or for economies of scale. There are three main approaches to deriving equivalence scales: (i) one relying on behavioral analysis to estimate equivalence scales, (ii) one using direct questions to obtain subjective estimates, and (iii) one that simply sets scales in some reasonable, but essentially arbitrary, way. Each of these is discussed in turn in the sections that follow. Our recommendation, apart from the continuing use of per capita expenditure, is the arbitrary method, and we offer some suggestions for its practical implementation.

### 5.3 BEHAVIORAL APPROACH:

The behavioral approach has generated a large literature, much of which is reviewed in Deaton (1997). While there are methods for calculating the costs of children that are relatively soundly based -- though not all would agree even with this -- there are so far no satisfactory methods for estimating economies of scale. Many of the standard methods, such as Engel's procedures for calculating both child costs and economies of scale, are readily dismissed, see again Deaton (1997) and Deaton and Paxson (1998). One idea that seems correct, and that can sometimes give a useful if informal notion of the extent of economies of scale, is that shared goods within the household, or household public goods, are the root cause of economies of scale. In the simplest case, there are two sorts of goods in the household, private goods, which are consumed by one person and one person only and where consumption by one person precludes consumption by another, and public goods, where there is an unlimited amount of sharing, and where consumption by one member of the household places no limitation on consumption by others. In this case, Drèze and Srinivasan (1997) have shown that, in a household with only adults, the elasticity of the cost-of-living with respect to household size is the share of private goods in total household consumption. If all goods are private, costs rise in proportion to the number of people in the household, while if all goods are public, costs are unaffected by the number of people. This sort of argument supports the intuitive notion that, in very poor economies with a high share of the budget devoted to food—which is almost entirely private—the scope for economies of scale is likely to be small. In other settings, where housing—which has a large public component—is important, economies of scale are likely to be larger. Unfortunately, attempts to extend this sensible approach to a more formal estimation of the extent of economies of scale have not been successful, Deaton and Paxson (1998).

### 5.4 SUBJECTIVE APPROACH:

The subjective approach to setting equivalence scales has attracted increased attention in recent years. One widely used technique is the "Leyden" method pioneered by van Praag and his associates, see van Praag and Warnaar (1997) for a recent review. In the household survey, each household is asked to provide estimates of the amount of income it would need so that their circumstances could be described as "very bad," "bad," "insufficient," "sufficient," "good," and "very good." Suppose that the answer to the "good" question by household $h$ is $c^h$. From the cross-section of results, $c^h$ is regressed on household income and family size (or numbers of adults and children) in the logarithmic form

$$\ln c^h = \alpha + \beta \ln n^h + \gamma \ln y^h \tag{5.1}$$

This equation is used to calculate the level of income $y^h$ which this household would have to have in order to name its actual income as "good." Evidently, this is given by

$$\ln \tilde{y}^h = \frac{\alpha}{1-\gamma} + \frac{\beta}{1-\gamma} \ln n^h \tag{5.2}$$

If $\tilde{y}^h$ is interpreted as a measure of needs in that it would be regarded by a household receiving it as "good," then the quantity $\beta / (1-\gamma)$ can be interpreted as the elasticity of needs to household size, and thus (a negative) measure of economies of scale. van Praag and Warnaar report an estimate of $\beta / (1-\gamma)$ for the Netherlands of 0.17, 0.50 for Poland, Greece, and Portugal, 0.33 for the US. Taken literally, these numbers indicate very large, not to say incredible, economies of scale.

Even if we accept the general methodology, it is hard to take these estimates seriously. In particular, if the costs of children, or more generally the costs of living together, vary from household to household, the estimation of (5.1) will lead to downward biased estimates of $\beta$. To see this, rewrite (5.1) including the error term as

$$\ln c^h = \alpha + \beta \ln n^h + \gamma \ln y^h + u^h \tag{5.1a}$$

The term $u^h$ varies from one household to the next, and represents the idiosyncratic costs of living for that household, the amount that household needs above the average for a household with its income and size. The trouble with this regression is that households choose their size $n^h$, partly through fertility, but more importantly by adults (and some children) moving in and out. People who like living with lots of other people will live in large households (high $n^h$) and will report that they need relatively little money to live in a large household (low $u^h$). As a result, the error term $u^h$ will be negatively correlated with household size $n^h$ and estimates of $\beta$ will be biased downward, consistently with what van Praag and Warnaar report.

### 5.5 ARBITRARY APPROACH:

Given the current unreliability of either the behavioral or the subjective approach, there is much to be said for making relatively *ad hoc* corrections that are likely to do better than deflating by household size. One useful approach, detailed in National Research Council (1995), is to define the number of adult equivalents by the formula

$$AE = (A + \alpha K)^{\theta} \tag{5.3}$$

where *A* is the number of adults in the household, and *K* is the number of children. The parameter $\alpha$ is the cost of a child relative to that of an adult, and lies somewhere between 0 and 1. The other parameter, $\theta$, which also lies between 0 and 1, controls the extent of economies of scale; since the elasticity of adult equivalents with respect to "effective" size, $A + \alpha K$ is $\theta$, $(1-\theta)$ is a measure of economies of scale. When both $\alpha$ and $\theta$ are unity—the most extreme case with no discount for children or for size—the number of adult equivalents is simply household size, and deflation by household size is equivalent to deflating to a per capita basis. An alternative version of (5.3) is frequently used in Europe, whereby the first adult counts as one, and subsequent adults are discounted, so that the *A* in (5.3) is replaced by $1 + \beta(A-1)$ for some β less than unity. This is really an alternative treatment of economies of scale so that, if this scheme is used, the parameter θ would normally be set to unity.

A case can be made for the proposition that current best practice is to use (5.3) for the number of adult equivalents, simply setting $\alpha$ and $\theta$ at sensible values. Most of the literature -- as well as common sense -- suggests that children are relatively more expensive in industrialized countries (school fees, entertainment, clothes, etc.) and relatively cheap in poorer agricultural economies. Following this, $\alpha$ could be set near to unity for the US and western Europe, and perhaps as low as 0.3 for the poorest economies, numbers that are consistent with estimates based on Rothbarth's procedure for measuring child costs, Deaton and Muellbauer (1986) and Deaton (1997). If we think of economies of scale as coming from the existence of shared public goods in the household, then $\theta$ will be high when most goods are private and low when a substantial fraction of household expenditure is on shared goods, see Section 5.3 above. Since households in the poorest economies spend as much as three-quarters of their budget on food, and since food is an essentially private good, economies of scale must be very limited, and $\theta$ should be set at or close to 1. In richer economies, $\theta$ would be lower, perhaps in the region of 0.75.

In Section 6 below, we argue that it is important to assess the robustness of poverty comparisons using stochastic dominance techniques, and we sketch out a simple methodology for doing so. When the results are not robust, for example when the comparison of poverty rates between children and the elderly is sensitive to the choice of $\alpha$ and $\theta$ within the sensible range for that country, there is probably not much alternative to facing failure squarely. Certainly the behavioral approach is unlikely to provide estimates that would be sufficiently precise and sufficiently credible to support such fine distinctions. In such situations, it might be better to turn to other indications of well-being, such as mortality or morbidity. When the analyst is not concerned with situations in which everything depends on the choice of $\alpha$ and $\theta$—for example in comparing the poverty of children and the elderly—our recommendations are straightforward. At the first round, calculate per capita expenditure for each household by deflating the expenditure aggregate by household size. As an alternative, and likely more accurate supplement, use the arbitrary method, with values of $\alpha$ and $\theta$ set according to the level of development. In poor economies, we recommend setting $\alpha$ low, perhaps 0.25 or 0.33, and setting $\theta$ high, perhaps 0.9. Children are not very costly in poor, agricultural economies, and when the budget share of food is high, there is not much scope for economies of scale. As we move to richer economies, children are relatively more expensive, and economies of scale larger. NRC (1995) recommended setting both parameters to 0.75 for the US, and others have noted that the official US poverty lines are quite well approximated by setting $\alpha$ to be 0.5 and $\theta$ to be unity. To some extent, these parameters are substitutes for one another; a low $\alpha$ goes with a high $\theta$, and vice versa.

For those actually constructing these measures, there is an important technical point that is discussed in the second paragraph of Section 6.4 below; expenditure measures divided by equivalence scales need to be normalized prior to use.

**Box 3. Adjustments for Cost-of-Living Differences and Household Composition**

| Issue | Recommendation |
|---|---|
| **Cost-of-Living Differences** | |
| Nominal consumption aggregate must be adjusted to take into account differences in cost-of-living in different parts of the country | Use price indexes to adjust nominal consumption |
| Often a variety of alternative sources for price data, including (i) unit values from the survey itself, (ii) prices collected in the price (community) questionnaire, and (iii) ancillary data, for example, from govt. CPI surveys | Use within-survey prices supplemented by prices from the price questionnaire, if available |
| Different types of prices indexes: | |
| <u>Paasche Index:</u> A useful approximation in calculating the (log of the) index is to take a weighted average of (the log of) the ratio of prices faced by the household relative to a set of reference prices, where the weights of each price relative are the budget share devoted by the household to the good concerned; in practice, because prices are rarely if ever available at the household level for each and every good consumed by the household, prices obtained from the community questionnaire can be used as a proxy for the prices faced by the household for some of these goods | The Paasche index is our preferred price index to use to adjust for cost-of-living differences faced by different households. |
| <u>Laspeyres Index:</u> As above, the Laspeyres index can be approximated by a weighted average of (the log of) the relative prices, though in this case the weights used are the average (in a democratic, not plutocratic, sense) budget shares devoted to the good concerned in the sub-group of interest. Once again, price relatives for a subset of good may need to be taken from the community (or price) questionnaire instead | |
| **Household Composition** | |
| Household aggregate needs to be adjusted to take into account differences in size and composition amongst households | Need to deflate household aggregate by appropriate measure of size/composition |
| Different methods of deriving deflators, including the behavioral approach, the subjective approach, and the arbitrary approach | Continue using PCE supplemented with measures based on the arbitrary approach |
| Choice of parameters $\alpha$ and $\theta$ | Use low $\alpha$ and high $\theta$ in poor countries, and the reverse in richer countries |

# 6. METHODS OF SENSITIVITY ANALYSIS:

## 6.1 INTRODUCTION:

Although the general procedures for calculating money metric utility are well-defined in theory, in practice, compromises have to be made, and difficult choices have to be made between imperfect alternatives. Is it better to add in a poorly measured component of consumption—such as imputed rent, or a component that is lumpy and transitory—such as health expenditures—and sacrifice accuracy for an attempt at completeness? Decisions about equivalence scales are almost always controversial, and even if we use the formulas (5.3) or (5.4), how do we know that the results are robust to the choice of parameters that control child costs and economies of scale? Even with perfect estimates of money metric utility, poverty analysis is subject to its own inherent uncertainty associated with the difficulty of choosing a poverty line. Although there is much to be said for making the best decisions one can, picking a sensible poverty line, and pressing ahead, it is often informative to examine the sensitivity of key results to alternatives. In recent years, much use has been made of *stochastic dominance* analysis to examine the sensitivity of poverty measures to different poverty lines, and this work has led to a much closer integration between poverty measurement and welfare analysis more generally. Stochastic dominance techniques can also be useful in examining the sensitivity of poverty analyses to the way in which money metric utility is constructed, including the construction of equivalence scales. In this Section, we explore some of these issues.

## 6.2 STOCHASTIC DOMINANCE:

Suppose that we have a money metric utility measure which, for the moment and to reduce notational clutter, we denote by $x$. Suppose too that we are interested in the headcount ratio (HCR), the proportion of people whose money metric utility is below the poverty line $z$. If $F(.)$ is the cumulative density function of $x$ in the population, $F(z)$ is the fraction below $z$, and thus is the HCR. The sensitivity of the HCR to changes in $z$, can be assessed simply by plotting the HCR as a function of $z$, i.e. by plotting the cdf $F(z)$ as a function of $z$. Suppose then that we have two measures of money metric utility, $x_0$ and $x_1$, corresponding to two different decisions about construction. Suppose that these decisions are such that it makes sense to use the same poverty line for both -- this will be the case if both are unbiased for the true money metric utility, and neither is more precise than the other. We discuss what happens when this is not the case in the subsections below, though it is sometimes obvious how to adapt the poverty line in moving from one situation to the other. Then if the two cdfs are $F_1(.)$ and $F_2(.)$, the two HCRs are $F_1(z)$ and $F_2(z)$. Plotting both of these functions against $z$ on a single graph shows which gives the higher HCR, and how the difference in HCRs varies with the choice of the poverty line $z$. Figure 2 illustrates the lower part of the cumulative distribution

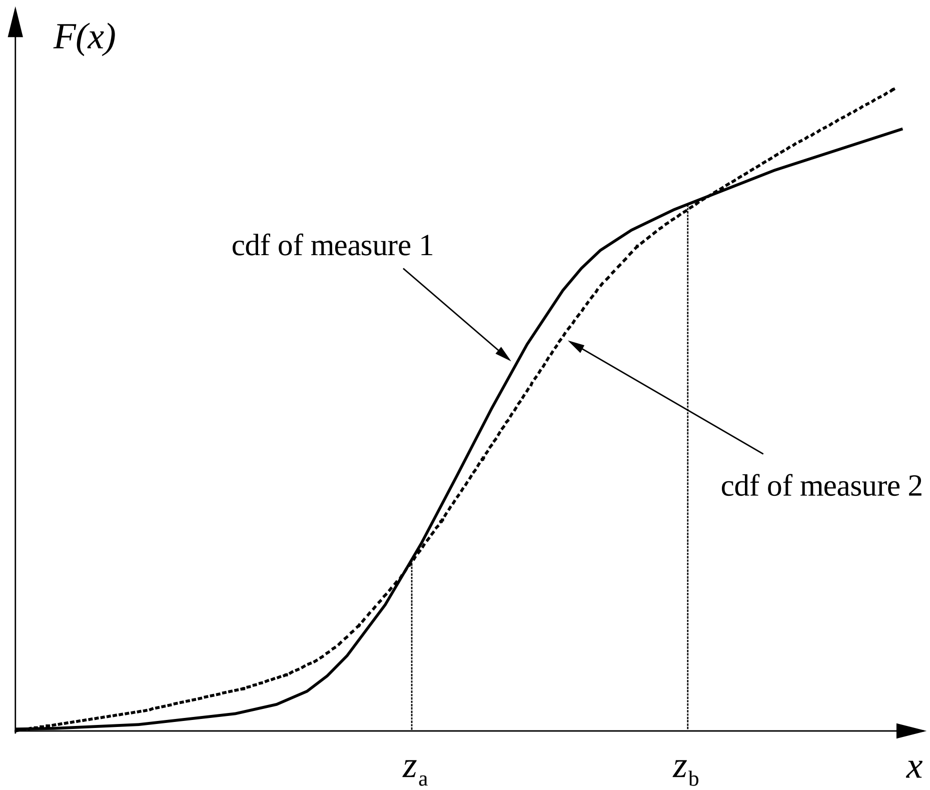



**Figure 2: Cumulative distribution functions of two measures of welfare**

functions for two (imaginary) measures of welfare. If the horizontal axis is thought of as the poverty line, each line tells us the fraction of people in poverty corresponding to that poverty line. Putting the two graphs on the same figure tells us how robust the head count ratio will be to the choice of measure at different poverty lines. For any low enough poverty line below $z_a$, the headcount ratio will be higher for measure 2. Between choice of poverty line between $z_a$, and $z_b$, measure 1 gives the higher poverty count, reversing again above $z_b$. Given some idea of the relevant poverty line, such figures tell us how the choice of measure affects the headcount.

This rather mechanical exercise becomes more interesting when we come to construct poverty profiles, for example for different groups, such as children and the elderly, or households in different regions. Suppose that we have two groups $G$ and $H$, and that the conditional cdfs of the two measures are now $F_1(\,.|G\,)$ and $F_2(\,.|G\,)$ for $G$ with similar expressions for $H$. What we are typically concerned about is whether the relative poverty rates of $G$ and $H$ are sensitive to the choice between the two measures, and to what extent the conclusion depends on the choice of the poverty line. For poverty line $z$, and measure $i$, for $i$ equal to 1 or 2, the difference in poverty rates between the two groups is

$$\Delta_i(z) = F_i(\,z|G\,) - F_i(\,z|H\,). \tag{6.1}$$

Plotting $\Delta_i(\,z\,)$ against $z$ for a given $i$, and seeing whether it ever cuts the horizontal axis, tells us whether the poverty ranking of the two groups is sensitive to the choice of poverty line. Plotting the two $\Delta$ functions on the same graph tells us whether, at any given poverty line, the ranking is sensitive to the construction of the utility measure, and whether that sensitivity (or lack of it) depends on the choice of poverty line. A worked example of this kind of analysis is given in Section 6.3 below.

Sensitivity calculations for the head-count ratio involve the comparison of the cdfs of two distributions. Similar calculations are possible for other poverty measures; for example, the sensitivity of the poverty gap measure to the poverty line can be examined by plotting the areas under the cdfs, see Deaton (1997) for a review of the literature and for examples. These higher order stochastic dominance comparisons can be used in the same way as above to examine the effects of construction on higher-order poverty measures.

### 6.3 Using subsets of consumption and the effects of measurement error:

It is often clear from the data collection exercise or from the subsequent analysis of the data that some components of consumers' expenditure are much better measured than others. Food is sometimes thought to be easier to measure than non-food, if only because in households that eat from a common pot, there is a single well-informed individual who can act as respondent. Imputations are often quite suspect, for example, those for imputed rent for owner occupiers in an economy where house tenancy is very rare. As a result, most analysts who have had to work through an LSMS survey, writing code to make the imputations, tend to be rather unwilling to make much use of the subsequent numbers. Whether it is better to use a subset of well-measured expenditures to assess poverty is an important question that has been raised by Lanjouw and Lanjouw (1996). As we have already seen, essentially the same issues arise in deciding whether or not to include an expenditure item where there are large, occasional expenditures. Transitory expenditure around a longer run mean is effectively the same as measurement error. In the rest of this subsection, we sketch out some results that are useful in thinking about measurement error and transitory expenditure. While we follow the lead of Lanjouw and Lanjouw, there are some differences in the analysis, both in methods and in results.

Before going on, it is worth noting that instrumental variable techniques for measurement error that are standard for making imputations, or for correcting regression analysis, are of more limited use when we are concerned with measuring poverty or inequality. The essential problem is that poverty and inequality depend on dispersion, not means, or even conditional means. If we are trying to estimate the mean expenditure of the population on some item, and some households have missing or implausible values, it is standard practice to impute an estimate, often from the mean of similar households, or more generally, from a regression using instruments, variables that are thought to be correlated with the missing information. But because such regressions only capture a fraction of the variation in the true variable, the fitted values will be less variable than the actuals, and imputation will tend to reduce inequality and poverty (if the poverty line is low enough.) Of course, for transitory expenditures and for measurement error, variance reduction is exactly what we want. But imputations are likely to eliminate not only the measurement error, but also the genuine variation across households, something that we need to preserve.

Start by assuming that there is a subset of total expenditure, such as food, expenditure on which is denoted by *e*, and that, conditional on total expenditure, *x*, we have

$$E(e|x) = m(x);\;\; V(e|x) = \sigma^2. \tag{6.2}$$

The regression function $m(x)$ can be thought of as an Engel curve, or as the true value of *x* when *x* is measured with error, or the long-run value of *x* when *x* has a large transitory component. The poverty line in terms of *x* is, as before, *z*, and the cdf of *x* is $F(.)$, so that the head count ratio is $F(z)$. Suppose that, instead of defining the poor in terms of low *x*, we define them in terms of low *e*; to do so, we must select an appropriate poverty line for *e*, and one obvious choice is to take the level of *e* on the Engel curve where total expenditure is equal to the poverty line, i.e. $m(z)$. The headcount ratio using *e* is then given by

$$P_e = F_e(m(z)) \tag{6.3}$$

where $F_e(.)$ is the cdf of *e*. If we assume that $m(x)$ is monotone, and therefore invertible, it can be shown that $P_e$ is related to the "true" headcount ratio $P_x$ by the approximation

$$P_e \approx P_x + \frac{\sigma^2 f(z)}{[m'(z)]^2}\left(\frac{f'(z)}{f(z)} - \frac{m''(z)}{m'(z)}\right) \tag{6.4}$$

where $f(x)$ is the pdf of *x*. (This result is closely related to those derived in a somewhat different context by

Ravallion, 1988.)

Note first that when the Engel curve fits perfectly (or there is no measurement error, or no transitory expenditure), so that $\sigma = 0,$ the two poverty lines coincide, a result that is exact. Otherwise, the two poverty counts will diverge in a way that depends on the slope of the density of *x* at the poverty line, and on the convexity or concavity of the Engel curve. When the Engel curve is linear or when we are dealing with transitory expenditures or measurement error, the second term in brackets is zero, so that "food" poverty will overstate "true" poverty if $f'(z) > 0$, which will occur if the density of *x* is unimodal and the poverty line is below the mode. If this condition holds, the overstatement will be exacerbated if the Engel curve is concave, and moderated if it is convex.

These results are a useful starting point, but are not directly practical. If we knew both *x* and its component *e*, there would be no need to use the latter. Nevertheless, there are two immediate corollaries that are more useful. The first is the case where $m(x) = x,$ so that *e* is just an error ridden measure of *x*, so that (6.4) becomes

$$P_e \approx P_x + \sigma^2 f'(z) \tag{6.5}$$

which gives us a guide about how measurement error inflates (or deflates) the poverty measure. This formula is particularly useful when we have some idea of the variance of the measurement error which, for example, could be estimated from two error-ridden but independent measures of *x*. Note also that (6.5) is the basis for the (often somewhat mysterious) result that for unimodal distributions, where $f'(x)$ is first positive and then negative, adding measurement error increases the head count ratio if the poverty line is below the mode, so that $f'(z) > 0,$ and decreases it when the poverty line is above the mode, where $f'(z) < 0.$ Except in the very poorest areas, we would expect the poverty line to be below the mode.

The approximation formula is also useful when considering whether or not to include a poorly measured component in the total. To simplify, suppose that *e* is the noncontroversial component of the total *x*, so that adding in the controversial component would, in principle, take us to the total *x*. Suppose that the Engel curve for *e* is linear, so that the derivative $m'(x)$ is constant, equal to β say. To avoid confusion, rewrite its variance around the regression line as $\sigma_e^2$, where the subscript *e* identifies the noncontroversial component. From (6.4), the poverty count using the comprehensive, but noisy measure is

$$P_c \approx P_x + \sigma_c^2 f'(z) \tag{6.6}$$

where $\sigma_c^2$ is the measurement error in the comprehensive (but noisy) total; *c* is for comprehensive. From (6.4), the poverty count using the non-controversial component alone is

$$P_e \approx P_x + \frac{\sigma_e^2 \ f'(z)}{\beta^2} \tag{6.7}$$

Since it is normally the case that the poverty line is below the mode, we can assume that $f'(z)$ is positive, in which case the poverty count based on the comprehensive but noisy measure will be closer to the truth if

$$\beta < \frac{\sigma_e}{\sigma_c} \tag{6.8}$$

Note that β is the share of the marginal rupee devoted to the non-controversial good, and that $1 - \beta$ is the share going to the controversial good, so that the case for inclusion of the controversial item is strong if, at the margin, a large share of total expenditure is devoted to it, while the case is weaker the larger is the ratio of variance in the comprehensive measure to the noncontroversial measure. This result is perhaps not surprising. A strong link to total expenditure is a case for inclusion, while making the total noisier is a case against conclusion. Note finally that (6.8) can be written in terms of the total-expenditure elasticity of the non-controversial component. $\varepsilon_e$ and the *relative* measurement errors as:

$$\varepsilon_e < \frac{\sigma_e / e}{\sigma_c / x} \tag{6.9}$$

Since the (weighted) sum of the controversial and noncontroversial elasticities is unity, (6.9) is a prescription of including controversial items if their total expenditure elasticities are large, provided they do not add too much measurement error. Ofcourse, neither $\sigma_e$ nor $\sigma_c$ can actually be observed in practice, but the formulas (6.8) and (6.9) tell us what to look for and what to think about when making the decision to trade off comprehensiveness versus precision.

### 6.4 Sensitivity analysis with equivalence scales:

Suppose that we are working with the formula (5.3) that links adult equivalents to the number of adults $A$ and the number of children $K$ according to

$$EA = (A + \alpha K)^{\theta} \tag{6.9}$$

and that we do not know $\alpha$ or $\theta$, though we may be prepared to commit to a range of values for each. Given values for the two parameters, we can compute money metric utility values for everyone so that, armed with a poverty line, we can calculate poverty rates for any groups. In this context, groups that we are particularly likely to be interested in are children, adults, and the elderly, as well as other groups where households have different sizes and compositions, such as rural versus urban households. Sensitivity analysis to different values of $\alpha$, $\theta$, and *z*, proceeds in very much the same way as discussed in Section 6.1 above.

However, as in Section 6.2 but in contrast to Section 6.1, we cannot simply change the parameters and leave the poverty rate unchanged. For example, suppose that $\alpha$ is set at 1, and $\theta$ is reduced from 1 to 0.5. As a result, *EA* would be reduced for all households except those with only a single person, so that, if the poverty line were held constant, poverty would be decreased. But this is not what we want changes in the parameters of the equivalence scale to do. Instead, we want to alter the relative standings of large households relative to small households, or households with large numbers of children relative to those with none. A straightforward way to do this is to select a particular household type as "pivot," and to choose the equivalence scale in such a way that the money metric utility of people in such households are unaffected by changes in the parameters. Denote the number of adults and children in the reference or pivot household by $(A_0, K_0)$; in practice this should be chosen as the modal type, for example, a two adult and three child household. We then define money metric utility, not as *x* divided by *AE*, but as

$$x^* = \frac{x}{(A+\alpha K)^\theta} \frac{(A_0+\alpha K_0)^\theta}{A_0+K_0} \tag{6.10}$$

At any given values of $\alpha$ and $\theta$, $x^*$ is just a scaled version of $x / AE$; but for the reference household, $x^*$ is always equal to per capita expenditure, and is unaffected by changes in $\alpha$ and $\theta$.

An alternative procedure, not pursued here but equally useful in practice, is to alter the poverty line for use with equivalent expenditure so as to hold constant the measure of interest, for example the head count ratio. This is most simply done by trial and error. Calculate per equivalent expenditures for each household by dividing total expenditure by equivalent adults calculated using the chosen values of $\alpha$ and $\theta$. For a trial poverty line, calculate the head count ratio, and continue adjusting until the head count ratio returns to its value using per capita expenditure. Equivalently, the ratio of the new to the old poverty lines can be used to deflate expenditure per equivalent, at which point the original poverty line can be used.

Figures 3—5 , reproduced from Deaton and Paxson (1997), show what happens to the relative poverty of children, non-elderly adults, and the elderly in South Africa using the 1993 South African LSMS. These calculations are done on an individual basis whereby when money metric utility is assigned to a household, it is assigned to each person in that household. When we are doing population calculations, such as a mean or a measure of dispersion, the money metric utility of the household is weighted by the product of the number of people in the household and the household's sampling weight or inflation factor. Figure 3 shows the cdfs for the three groups, for a range of possible poverty lines, and for nine combinations of values for $\alpha$ and $\theta$. Irrespective of the values chosen, and irrespective of the poverty line, non-elderly adults always have a lower headcount ratio than do children or the elderly. The poverty profile of the elderly versus that of children depends on the values of the parameters. In the top right of the figure, where children are cheap, and economies of scale are large, children do better than the elderly, who benefit relatively little from either economies of scale or inexpensive children. At the bottom left of the picture, where there are no discounts for children or for large size, so that money metric utility is expenditure per capita, the children are more likely to be poor than the elderly at all poverty lines.

Figures 4 and 5 show plots of the difference between the cdf for the elderly and the cdf for children for the same range of the poverty line, but with plots for different values of $\alpha$ and $\theta$ on the same graph. By discarding the automatic increase in the cdf with the level of the poverty line, and looking only at differences, these graphs permit greater focus on the differences of interest, here the elderly versus children. Figure 4 shows the movement on Figure 3 from top right to bottom left, and shows how children become relatively poorer, and that, in the middle configuration, with $\alpha = \theta = 0.75$, the relative poverty rates depend on the value of the poverty line. Figure 5 shows the progress through Figure 3 from top left to bottom right, and shows a more muddied picture. All three graphs show that the relative poverty rates of the two groups depend on the poverty line, with children tending to be less poor at higher values.

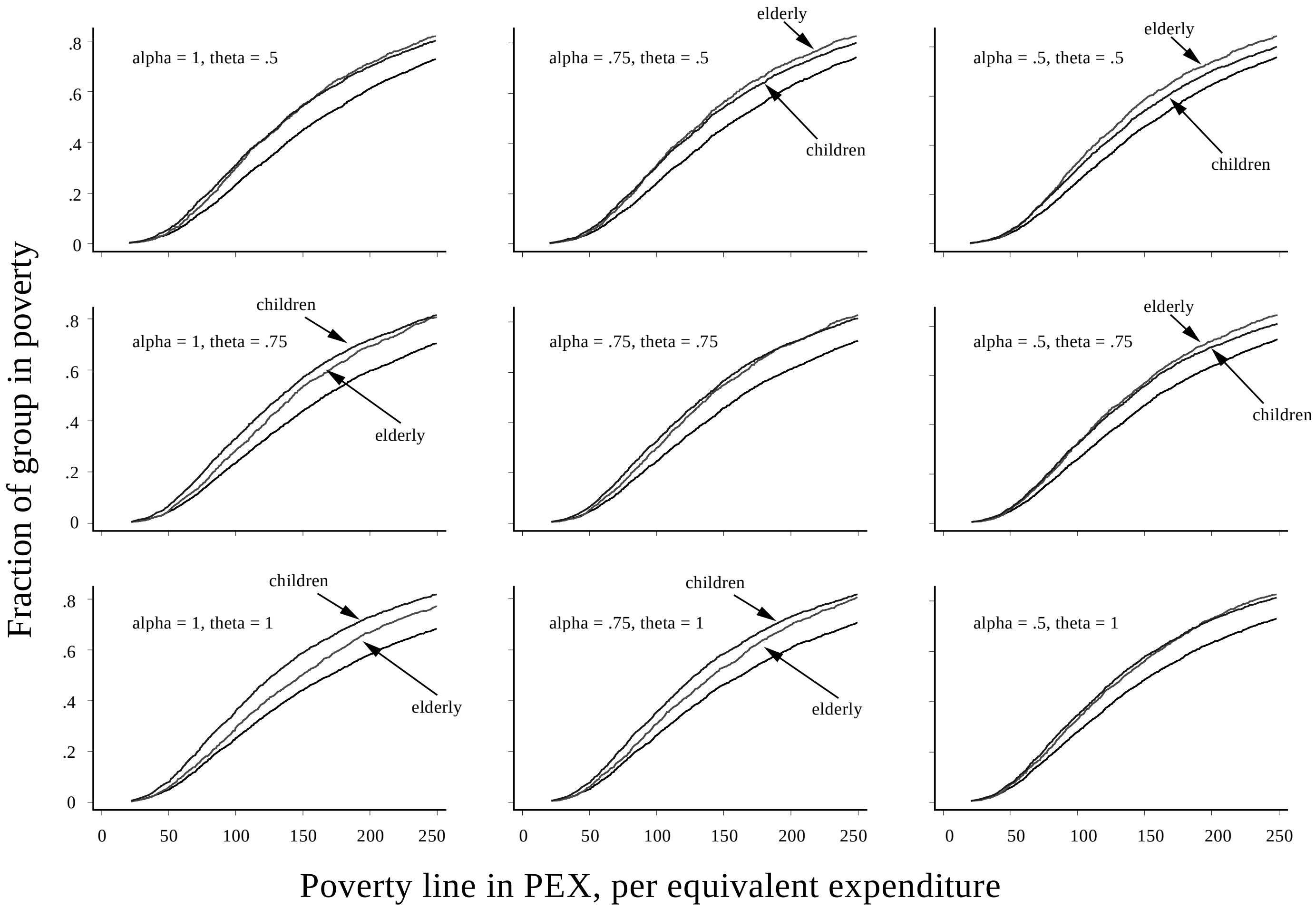



**Figure 3: South Africa, poverty headcount ratios at various poverty lines and for various child costs and economies of scale**

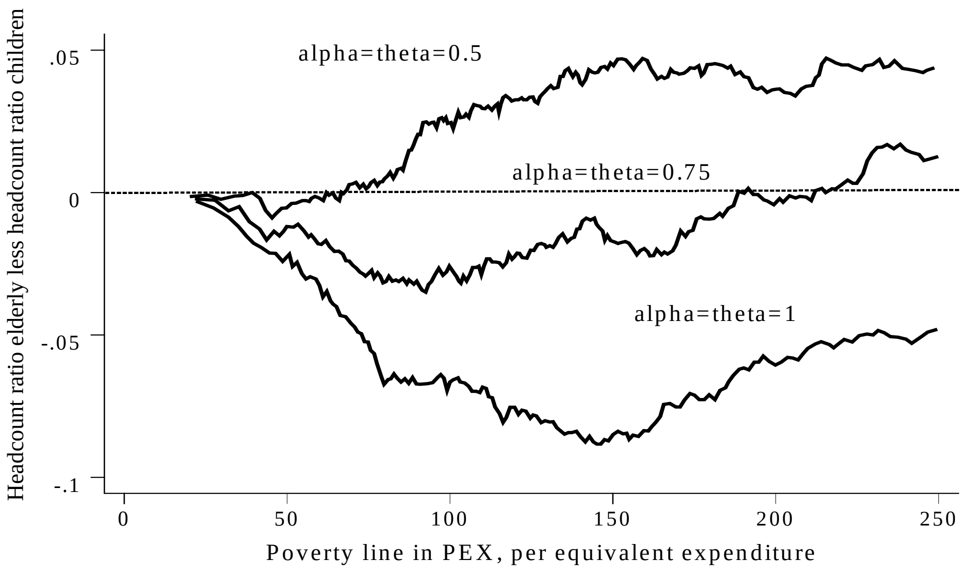
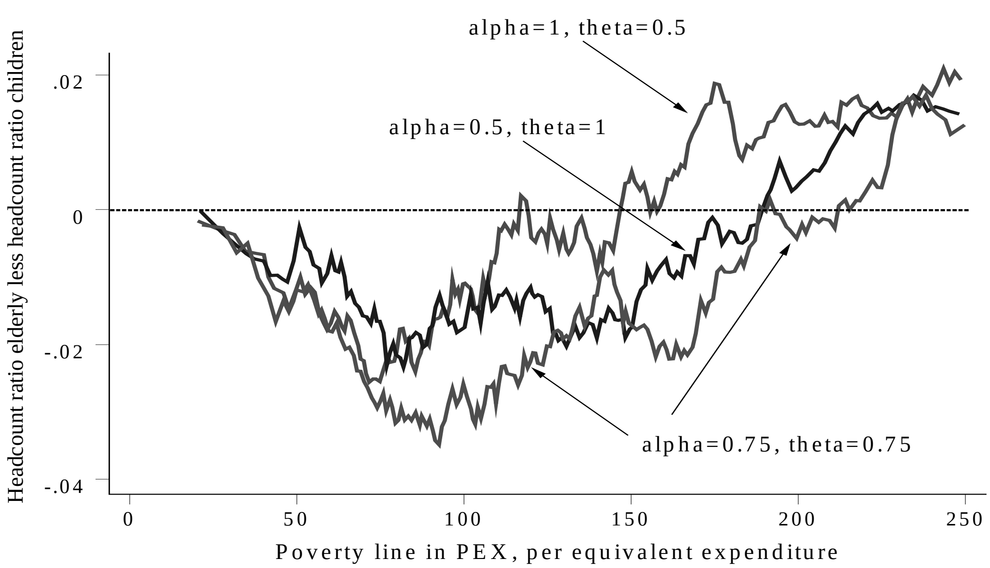



**Figure 4: South Africa: poverty rates of the elderly and children**

**Figure 5: South Africa: poverty rates of the elderly and children**



What should we conclude from sensitivity analyses like these? Much of the time, the desired result from a sensitivity analysis is to find that the results are robust, so that clear conclusions can be drawn. This will sometimes be the case, but rarely for the analysis of equivalence scales, where we know from a large body of work that some important issues are not robust. Indeed, Deaton and Paxson show similar sensitivities between the relative poverty rates of children and the elderly, not only for South Africa, but also for Ghana, Pakistan, Taiwan, and Thailand, but not Ukraine. In the absence of a breakthrough in behavioral and or subjective methods of measuring equivalence scales, it may simply be necessary for policy to be conducted in ignorance of the relative poverty of some groups.

This section is somewhat more speculative (as well as more technical) than the other sections in these guidelines. Nevertheless, there are a number of general points and recommendations that should be drawn from the analysis.

First, to the extent that the welfare measures are to be used for poverty analysis, and in particular the calculation of headcount ratios, the first order stochastic dominance techniques of Section 6.2 (illustrated for equivalence scales in this Section) are easy to use and often provide useful insights. That said, these techniques should not be used to check out the results of every controversial decision in constructing the consumption aggregates. There are so many points where judgment calls have to be made, and they combine with one another to produce an impossibly large number of alternatives. Decisions have to be made for better or worse. But there are often critical decisions, of which that about equivalence scales is one, and the inclusion of a noisy item of expenditure is often another, where we know in advance that the decision is going to matter for the poverty analysis, and where it is important to have more information on exactly how it matters. For this, stochastic dominance analysis is ideally suited.

Second, we have no recommendation about how to "correct" measurement error, a topic that is more a question of survey design. The crucial point is always to be aware of it existence, and to ask, every time a decision is made, whether or not that decision would be different depending on the extent of measurement error. We hope that the formulas in Section 6.3, although no panacea, will be helpful in that enterprise.

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# APPENDIX

## AN INTRODUCTION TO LIVING STANDARDS MEASUREMENT STUDY (LSMS) SURVEYS:

The Living Standards Measurement Study (LSMS) was established by the World Bank in 1980 to improve the availability of high quality household survey data collected by statistical offices in developing countries. One of the main purposes of surveys is to provide data on a number of different dimensions of household welfare, to better understand household behavior, and to evaluate the impact of various government policies and programs on living conditions. To-date, LSMS surveys have been conducted in over 40 countries throughout the world, and in a number of countries these surveys are now carried out at regular intervals by the statistical offices as part of their routine data collection activities. For a more comprehensive introduction to the World Bank's LSMS surveys, see Grosh and Glewwe (1998).

LSMS surveys typically use a number of different survey instruments to collect data: (i) a household questionnaire, (ii) a community questionnaire, (iii) a price questionnaire, as well as (iv) a school or health facilities questionnaire. The household questionnaire is usually administered to a relatively small sample of about 2,000—5,000 households, and typically collects data on a wide range of topics, including household demographics, economic activities, consumption of goods and services, housing conditions, access to services and amenities, as well as data on the health and educational status of all household members. In each of the localities throughout the country in which households are interviewed, a community questionnaire is also administered. This questionnaire collects information on the quality of infrastructure as well as on access to various services and amenities in the locality. A price questionnaire is also typically administered in each community, and this instrument collects data on prevailing prices of a wide range of goods and services on sale in the locality. Finally, a school and health facilities questionnaire is sometimes also administered in all school and health facilities that fall within the locality; this questionnaire typically collects information on staffing, the quality of infrastructure and range of services provided at the facility.

**AN INTRODUCTION TO THE PROGRAMS:**

In the pages that follow, the programs used to construct the consumption aggregates from data collected in LSMS surveys in Nepal as well as a few other countries is presented. For each of the major set of calculations discussed in the paper, the relevant section of the stata code used to construct this particular sub-aggregate is listed, along with copies of the relevant pages of the questionnaire as well as notes to guide the analyst through the syntax. These programs are included in the paper to provide "templates" for the user, rather than a set of programs that can be immediately executed as such to construct the consumption aggregate in a given country. Each survey is at least a little different from every other, so that the code that follows would—at a minimum—have to be modified for each country to take into account differences in structure of the questionnaire as well as to give due consideration to each country's unique circumstances and institutions, types of data collected in the survey, etc.

A1 includes the 6 Stata programs used to construct the consumption aggregate from the Nepal Living Standards Survey (NLSS) data, the LSMS conducted in Nepal in 1995. A2 provides an example of the stata code used to construct the Paasche price index based on the NLSS data set (the programs provided in A1 construct a Laspeyres price index). A3—A5 present examples of the code used to construct the durable goods consumption sub-aggregate in Vietnam, Panama, and the Kyrgyz Republic respectively—in each of these countries, the type of data collected varied in terms of detail. Finally, A6 and A7 include the Stata code used to construct the housing consumption sub-aggregate in South Africa and Vietnam respectively.

SECTION 5

FOOD EXPENSES AND HOME PRODUCTION

| | | | | FOOD PURCHASES | | | | HOME PRODUCTION | | | | IN-KIND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.<br>Have you consumed ..[FOOD].. during the past 12 months?<br>PUT A CHECK (✓) IN THE APPROPRIATE BOX FOR EACH FOOD ITEM. IF THE ANSWER TO Q. 1 IS YES, ASK Q. 2-8. | | | | 2.<br>How many months in the past 12 months did you purchase .[FOOD]. ?<br>IF NONE WRITE ZERO AND ➔5 | 3.<br>In a typical month during which you purchased ..[FOOD]. how much did you purchase? | | 4.<br>How much would you normally have to spend in total to buy this quantity? | 5.<br>How many months in the past 12 months did you consume .[FOOD]. that you grew or produced yourself?<br>IF NONE WRITE ZERO AND ➔8 | 6.<br>In a typical month during which you ate ..[FOOD]..,how much did your household consume of ..[FOOD]..? | | 7.<br>How much would your household have to spend in the market to buy this quantity of .[FOOD]. (i.e. the amount consumed in a typical month)? | 8.<br>What is the total value of the ..[FOOD].. consumed that you received in-kind over the past 12 months (wages for work, etc.)?<br>IF NONE WRITE ZERO |
| | NO | YES | CODE | MONTHS | QUANTITY | UNIT | RUPEES | MONTHS | QUANTITY | UNIT | RUPEES | RUPEES |
| **1. GRAINS & CEREALS:** | | | **010** | | | | | | | | | |
| Fine rice | | | 011 | | | | | | | | | |
| Coarse rice | | | 012 | | | | | | | | | |
| Beaten/flattened rice | | | 013 | | | | | | | | | |
| Maize | | | 014 | | | | | | | | | |
| Maize flour | | | 015 | | | | | | | | | |
| Wheat flour | | | 016 | | | | | | | | | |
| Millet | | | 017 | | | | | | | | | |
| Other grains/cereals | | | 018 | | | | | | | | | |
| **2. PULSES AND LENTILS:** | | | **020** | | | | | | | | | |
| Black Pulse | | | 021 | | | | | | | | | |
| Masoor | | | 022 | | | | | | | | | |
| Rahar | | | 023 | | | | | | | | | |
| Gram | | | 024 | | | | | | | | | |
| Other pulses | | | 025 | | | | | | | | | |
| . . . . . | | | | | | | | | | | | |
| **. . . . . upto code 132** | | | | | | | | | | | | |

## A1. 1995 NEPAL LIVING STANDARD SURVEY (NLSS) STATA CODE

**PROGRAM 1:**

```
* This program computes the annual household food consumption expenditure in
* three different components: purchased, received and home produced.
* wwwhh is a 5-digit code that uniquely identifies each household.

************************************************
*                                              *
*          Food consumption expenditure        *
*                                              *
************************************************

use data\sect05, clear
* See Section 5 from the questionnaire on the facing page

gen purchase = v0502 * v0504
*  v0502 and v0504 are variables with data from question 2 and 4 respectively
*  of section 5

drop v0502 v0503a v0503b v0504
gen hproduct = v0505 * v0507
drop v0505 v0506a v0506b v0507
rename v0508 inkind

* Taking out tobacco
egen tobacco=rsum(purchase hproduct inkind) if fooditm >=121 & fooditm <=124
replace purchase=. if fooditm>=121 & fooditm<=124
replace hproduct=. if fooditm>=121 & fooditm<=124
replace inkind=. if fooditm>=121 & fooditm<=124

collapse (sum) purchase hproduct inkind tobacco, by(wwwhh)
egen food= rsum(purchase hproduct inkind)

label var wwwhh "Household code"
label var purchase "Food purchases"
label var hproduct "Food home production"
label var inkind "Food in-kind receipts"
label var food "Food consumption"
label var tobacco "Tobacco consumption"
sort wwwhh
save consumption\food, replace
```

SECTION 7. EDUCATION PART C **CURRENT ENROLLMENT (ALL PERSONS 5 YEARS AND OLDER) (CONT.)**

| IDENTIFICATION CODE | 9. How much has your household spent during the past 12 months for your schooling? IF NOTHING WAS SPENT, WRITE ZERO. IF THE RESPONDENT CAN ONLY GIVE A TOTAL AMOUNT OF EXPENSES AND NOT THE BREAKDOWN PER TYPE, WRITE DK (DON'T KNOW) IN COLUMNS A TO G, AND THE TOTAL AMOUNT IN COLUMN H. | | | | | | | | 10. Did you receive a scholarship to help pay for your educational expenses? YES ........ 1 NO ......... 2 (➔NEXT PERSON) | 11. How much did you receive over the past 12 months? |
|---|---|---|---|---|---|---|---|---|---|---|
| | A. Admission, Registration and Tuition | B. Examination fees | C. Transportation fees and costs | D. Textbooks, writing supp. stationery etc | E. Private tutoring | F. Boarding fees | G. Other fees and expenses | H. TOTAL | | |
| | Rs. | Rs. | Rs. | Rs. | Rs. | Rs. | Rs. | Rs. | | RUPEES |
| 01 | | | | | | | | | | |
| 02 | | | | | | | | | | |
| 03 | | | | | | | | | | |
| 04 | | | | | | | | | | |
| 05 | | | | | | | | | | |
| 06 | | | | | | | | | | |
| 07 | | | | | | | | | | |
| 08 | | | | | | | | | | |
| 09 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |

**1995 NEPAL LIVING STANDARDS SURVEY (NLSS) STATA CODE**

**PROGRAM 2:**

```
* This program computes annual expenditure for education, health and other
* non food consumption.
* wwwhh is a 5-digit code that uniquely identifies each household.

***********************************************
*                                             *
*              Non Food expenditure           *
*                                             *
***********************************************

***----------- EDUCATION EXPENSES ---------------***

use data\sect07, clear
* See Section 7, Part C of the questionnaire on the facing page

* The total expenditure on education is taken to be either the sum of the
* reported education expenditure sub-categories (a – g) or the total reported
* in column h, whichever is greater.
egen toteduc= rsum(v07c09a v07c09b v07c09c v07c09d v07c09e v07c09f v07c09g)
replace toteduc= v07c09h if (toteduc < v07c09h) & toteduc~=. & v07c09h~=.
* Adding in value of scholarship
egen educatn= rsum(toteduc v07c11)
collapse (sum) educatn, by(wwwhh)
label var educatn "Education expenditure"
sort wwwhh
save consumption\educatn.dta, replace
```

SECTION 6. NON-FOOD EXPENDITURES AND INVENTORY OF DURABLE GOODS PART A

FREQUENT NON-FOOD EXPENDITURES

| 1. Were any of the following items purchased or received in-kind over the past 12 months? PUT A CHECK (✓) IN THE APPROPRIATE BOX FOR ALL ITEMS. IF THE ANSWER IS YES, ASK Q 2-3. | | | | What is the money value of the amount purchased or received in-kind by your household during the past: AMOUNT IN RUPEES | |
|---|---|---|---|---|---|
| | NO | YES | CD | 2. 30 DAYS | 3. 12 MONTHS |
| 21. FUELS: | | | 210 | | |
| Wood (bundlewood, logwood etc.) | | | 211 | | |
| Kerosene oil | | | 212 | | |
| Coal, charcoal | | | 213 | | |
| Cylinder gas | | | 214 | | |
| Matches, candles, flint, lighters, lanterns, etc. | | | 215 | | |
| 22. APPAREL AND PERSONAL CARE ITEMS: | | | 220 | | |
| Ready-made clothing and apparel | | | 221 | | |
| Cloth, wool, yarn, and thread for making clothes and sweaters | | | 222 | | |
| Tailoring expenses | | | 223 | | |
| Footwear (shoes, slippers, chappals, etc.) | | | 224 | | |
| Toilet soap | | | 225 | | |
| Toothpaste, tooth powder, toothbrush, etc.) | | | 226 | | |
| Other personal care items (shampoo, cosmetics, etc.) | | | 227 | | |
| Dry cleaning and washing expenses | | | 228 | | |
| Personal services (haircuts, shaving, shoeshine, etc.) | | | 229 | | |

| PUT A CHECK (✓) IN THE APPROPRIATE BOX FOR ALL ITEMS. IF THE ANSWER IS YES, ASK Q 2-3. | | | | your household during the past: AMOUNT IN RUPEES | |
|---|---|---|---|---|---|
| | NO | YES | CD | 2. 30 DAYS | 3. 12 MONTHS |
| 23. OTHER FREQUENT EXPENSES: | | | 230 | | |
| Public transportation (buses, taxis, train tickets etc.) | | | 231 | | |
| Petrol, diesel, motor oil for personal vehicle only | | | 232 | | |
| Entertainment (cinema, radio tax, cassette rentals, etc.) | | | 233 | | |
| Newspapers, books, stationery supplies | | | 234 | | |
| Pocket money to children | | | 235 | | |
| Educational and professional services | | | 236 | | |
| Modern medicines&hlth. services (fees, hospital charges etc.) | | | 237 | | |
| Traditional medicines and health services | | | 238 | | |
| Wages paid to servants, malie, chowkidars, etc. | | | 239 | | |
| Light bulbs, shades, batteries, etc. | | | 241 | | |
| Household cleaning articles (soap, washing powder, etc.) | | | 242 | | |

| | | |
|---|---|---|
| TOTAL: (210 + 220 + 230) 250 | | |
| ASK RESPONDENT TO ESTIMATE AVE. MONTHLY & ANNUAL 260 EXPENDITURE ON FREQUENTLY PURCHASED NON-FOOD ITEMS | | |

| 1. Were any of the following items purchased or received in-kind over the past 12 months? | What is the money value of the amount purchased or received in-kind by |
|---|---|

```
***----------- HEALTH EXPENDITURE ---------------***

use data\sect06ab, clear
keep if nfooditm==237 | nfooditm==238
gen hmonth=12*v0602
recode hmonth .=0
gen hannual=v0603
replace hannual=hmonth if hannual==.
collapse (sum) health= hannual, by(wwwhh)
sort wwwhh
save consumption\health, replace

***--------- OTHER NON-FOOD EXPENSES ------------***

use data\sect06ab, clear

* Drop subtotals
drop if int(nfooditm/10) == (nfooditm/10)
* Drop expenditure on firewood
drop if nfooditm==211
* Drop education
drop if nfooditm==236
* Drop health
drop if nfooditm==237 | nfooditm==238
* Drop taxes, etc.
#delimit ;
drop if nfooditm==312 | nfooditm==313 | nfooditm==317 | nfooditm==318 |
     nfooditm==319;
#delimit cr
* Drop misc. expenses
drop if  nfooditm>=321 &  nfooditm<=328
* Drop durable goods except 411 (crockery, cutlery and kitchen utensils)
* and 413 (pillows, mattress, blankets,..)
drop if  nfooditm> 400 & (nfooditm~=411 & nfooditm~=413)
* Drop fuels
drop if nfooditm>=211 & nfooditm<=215

gen nfood_m = 12*v0602
recode nfood_m .=0
gen nfood1= v0603
replace nfood1= nfood_m if nfood1== 0 | nfood1==.
collapse (sum) nfood1, by(wwwhh)
label var nfood1 "Non-food expenditures"
keep wwwhh nfood1
sort wwwhh
save consumption\nfood1, replace
```

SECTION 2. HOUSING PART A **TYPE OF DWELLING**

1. Is this dwelling unit occupied by your household only?

YES .................. 1
NO ................... 2

2. How many rooms does your household occupy?

- TOTAL
- KITCHEN
- TOILET/BATHROOM
- BEDROOMS
- LIVING/DINING ROOMS
- BUSINESS
- MIXED USE
- OTHER

INTERVIEWER: PLEASE PROVIDE THE FOLLOWING INFORMATION ON THE RESPONDENT HOUSEHOLD'S DWELLING UNIT (Q.

3. IS THERE A KITCHEN GARDEN?

YES .................. 1
NO ................... 2

4. MAIN CONSTRUCTION MATERIAL OF OUTSIDE WALLS:

CEMENT BONDED BRICKS/STONES1
MUD BONDED BRICKS/STONES . 2
WOOD/BRANCHES ............ 3
CONCRETE ................. 4
UNBAKED BRICKS ........... 5
OTHER PERMANENT MATERIAL . 6
NO OUTSIDE WALLS ......... 7

5. MAIN FLOORING MATERIAL:

EARTH .................... 1
WOOD ..................... 2
STONE-BRICK .............. 3
CEMENT/TILE .............. 4
OTHER .................... 5

6. MAIN MATERIAL ROOF IS MADE OF:

STRAW, THATCH ............ 1
EARTH/MUD ................ 2
WOOD, PLANKS ............. 3
GALVANIZED IRON .......... 4
CONCRETE, CEMENT ......... 5
TILES/SLATE .............. 6
OTHER .................... 7

7. THE WINDOWS ARE FITTED (CHECK THE FIRST THAT APPLIES)

NO WINDOWS/ NO COVERING ... 1
SHUTTERS ................. 2
SCREENS/GLASS ............ 3
OTHER .................... 4

8. HOW BIG IS THE HOUSING PLOT?

SQ. FT.

9. HOW BIG IS THE INSIDE OF THE DWELLING?

SQ. FT

**1995 NEPAL LIVING STANDARDS SURVEY (NLSS) STATA CODE**

**PROGRAM 3:**

```
* This program computes housing annual consumption in two different
* components: rent and utilities
* wwwhh is a 5-digit code that uniquely identifies each household.

************************************************
*                                              *
*              Housing consumption             *
*                                              *
************************************************

***------------ RENT EXPENDITURE ---------------***

use data\sect02, clear

* Rename and prepare variables used to impute rents
drop v02d*
gen housrent =  v02b03
replace housrent = v02b07 if v02b06==2 | v02b06==3 | v02b06==4
replace housrent = v02b09 if  v02b06==1
gen rstatus=1 if  v02b06 == 1
replace rstatus=2 if  v02b01 == 1
replace rstatus=2 if  v02b06 > 1
gen    rooms = v02a02a - v02a02b
gen  kitchen = (v02a02b >= 1.)
gen dwelsize = v02a09
gen    walls = (v02a04==1 | v02a04==4)
gen    floor = (v02a05==3 | v02a05==4)
gen     roof = (v02a06==4 | v02a06==5)
gen   window = (v02a07==2 | v02a07==3)
gen    water = (v02c02==1)
gen sanitatn = (v02c02==1)
gen  garbage = (v02c05==1 | v02c05==2)
gen   toilet = (v02c07==1)
gen    light = (v02c08==1)
gen telephon = (v02c11==1)
#delimit ;
keep wwwhh www rstatus housrent rooms kitchen dwelsize walls floor
     roof window water garbage sanitatn toilet light telephone;
#delimit cr
sort wwwhh
merge wwwhh using data\group
drop _merge
gen kathmand = (group==1)
gen othurban = (group==2)
gen  rwhills = (group==3)
gen  rehills = (group==4)
gen  rwterai = (group==5)
gen   lnrent = ln(housrent)
gen  lnrooms = ln(rooms)
gen lndwsize = ln(dwelsize)
```

SECTION 2. HOUSING PART B | HOUSING EXPENSES

1. Is this dwelling yours?

YES .................. 1
NO ................... 2 (➔6)

2. If you wanted to buy a dwelling just like this today, how much money would you have to pay?

INCLUDE VALUE OF HOUSING PLOT

RUPEES

3. If someone wanted to rent this dwelling today, how much money would they have to pay each month?

RUPEES

4. Did you rent out part of this dwelling unit?

YES .................. 1
NO ................... 2 (➔PART C)

5. How much do you receive as rent per month?

RUPEES

➔ PART C

6. What is your present occupancy status?

RENTER .............. 1 (➔8)
PROVIDED FREE OF CHARGE
BY RELATIVES, LANDLORD
OR EMPLOYER ...... 2
SQUATTING ........... 3
OTHER ............... 4

7. If someone wanted to rent this dwelling today, how much money would they have to pay each month?

RUPEES

➔ PART C

8. From whom are you renting?

PRIVATE INDIVIDUAL...1
RELATIVE.............2
EMPLOYER.............3
OTHER................4

9. What is the rent per month? (cash plus value of in-kind payments)

RUPEES

10. Does the rent include:

YES....1
NO.....2

ELECTRICITY

WATER

TELEPHONE

**1995 NEPAL LIVING STANDARDS SURVEY (NLSS) STATA CODE**

```
sort wwwhh
save consumption\housing, replace

* Add information on access facilities and durable assets
use data\sect06c
collapse (sum) durasset=v06c06, by(wwwhh)
sort wwwhh
save temp1, replace
use data\sect03, clear
keep if fcode == 104 | fcode == 105 | fcode == 106
gen    proad = (v0302 == 6 & fcode == 104)
gen othroad1 = (v0302 == 6 & fcode == 105)
gen othroad2 = (v0302 == 6 & fcode == 106)
collapse (sum) proad othroad1 othroad2, by(wwwhh)
sort wwwhh
save temp2, replace
use consumption\housing, clear
merge wwwhh using temp2
drop _merge
sort wwwhh
merge wwwhh using temp1
gen lnasset = ln(durasset)
drop _merge durasset
save consumption\housing, replace

* Predicting rents for households
#delimit ;
reg lnrent kathmand othurban rwhills rehills rwterai lnrooms lndwsize
    lnasset kitchen proad walls floor roof window water garbage toilet
    light telephon if lnrent> 0;
#delimit cr

replace lnrooms=ln(3) if lnrooms==.
replace lndwsize=ln(500) if lndwsize==.
recode lnasset  .=0
recode kitchen  .=0
recode proad .=0
recode walls .=0
recode floor .=0
recode roof .=0
recode window .=0
recode water .=0
recode garbage .=0
recode toilet .=0
recode light .=0
recode telephon .=0

predict renthat
gen     hhrent = exp( lnrent)*12 if lnrent > 0
replace hhrent = exp(renthat)*12 if hhrent ==.
```

SECTION 2. HOUSING PART C UTILITIES AND AMENITIES

1. Where does your drinking water come from?

PIPED WATER SUPPLY ... 1
COVERED WELL/HAND PUMP 2 (➔3)
OPEN WELL ............ 3 (➔3)
OTHER WATER SOURCE ... 4 (➔3)

2. Do you have water piped into your house?

YES .................. 1
NO ................... 2

3. How much did you pay for water over the last 12 months?
(EXCLUDE WATER USED FOR IRRIGATION)

IF NOTHING, WRITE ZERO

RUPEES

4. Are you connected to a sanitary system for liquid wastes?

YES, UNDERGROUND DRAINS .....1
YES, OPEN DRAINS ............2
YES, SOAK PIT ...............3
NO ..........................4

5. How does your household dispose of its garbage?

COLLECTED BY GARBAGE TRUCK ....1
PRIVATE COLLECTOR .............2
DUMPED ........................3 (➔7)
BURNED/BURIED .................4 (➔7)
DUMPED AND USED FOR FERTILIZER 5 (➔7)
OTHER ......................... 6

6. How much do you pay for garbage disposal over the last 12 months?

IF NOTHING, WRITE ZERO

RUPEES

7. What type of toilet is used by your household?

HOUSEHOLD FLUSH (CONNECTED
TO MUNICIPAL SEWER) ......... 1
HOUSEHOLD FLUSH (CONNECTED
TO SEPTIC TANK) ............. 2
HOUSEHOLD NON-FLUSH ......... 3
COMMUNAL LATRINE ............ 4
NO TOILET ................... 5

```
keep wwwhh hhrent
sort wwwhh
save consumption\hhrent, replace

erase temp1.dta
erase temp2.dta

***-------- CONSUMPTION OF UTILITIES ---------***

use data\sect06ab, clear
keep if nfooditm>=211 & nfooditm<=215
gen fuel_m= 12*v0602
recode fuel_m .=0
gen fuel= v0603
replace fuel=fuel_m if fuel==0 | fuel==.
collapse (sum) fuel, by(wwwhh)
label var  fuel "Fuel expenditures"
keep wwwhh fuel
sort wwwhh
save consumption\fuel, replace

use data\sect02, clear
keep wwwhh v02c06 v02c10 v02c12
rename v02c06 garbage
rename v02c10 electric
rename v02c12 telephon
sort wwwhh
merge wwwhh using consumption\fuel
drop if _merge==2
drop _merge
egen utility= rsum(fuel garbage electric telephon)
keep wwwhh utility
sort wwwhh
save consumption\utility, replace
```

SECTION 6. NON-FOOD EXPENDITURES AND INVENTORY OF DURABLE GOODS PART C **INVENTORY OF DURABLE GOODS**

| 1.<br><br>Does your household own any of the following items?<br><br>PUT A CHECK (✓) IN THE APPROPRIATE BOX FOR ALL ITEMS. IF THE ANSWER IS YES, ASK Q. 2-6 | | | | 2.<br><br>How many ..[ITEM].. does your household own? | 3.<br><br>How many years ago did you acquire ..[ITEM]..?<br><br>IF MORE THAN ONE ITEM OWNED, ASK ABOUT MOST RECENTLY ACQUIRED ITEM | 4.<br><br>Did you purchase it, receive it as a gift or payment for services, or receive it as dowry or inheritance?<br><br>PURCHASE ............1<br>GIFT/PAYMENT ........2<br>DOWRY/INHERITANCE ...3 | 5.<br><br>How much was it worth when you acquired it? | 6.<br><br>if you wanted to sell this ..[ITEM].. today, how much money would you receive for it?<br><br>IF MORE THAN ONE ITEM OWNED, ASK ABOUT TOTAL VALUE OF ALL ITEMS |
|---|---|---|---|---|---|---|---|---|
| ITEM | NO | YES | CODE | No: | YEARS | | RUPEES | RUPEES |
| Radio / cassette player | | | 501 | | | | | |
| Camera/camcorder | | | 502 | | | | | |
| Bicycle | | | 503 | | | | | |
| Motorcycle / scooter | | | 504 | | | | | |
| Motor car etc. | | | 505 | | | | | |
| Refrigerator or freezer | | | 506 | | | | | |
| Washing machine | | | 507 | | | | | |
| Fans | | | 508 | | | | | |
| Heaters | | | 509 | | | | | |
| Television / VCR | | | 510 | | | | | |
| Pressure lamps / petromax | | | 511 | | | | | |
| Telephone sets / cordless | | | 512 | | | | | |
| Sewing machine | | | 513 | | | | | |
| Furniture and rugs | | | 514 | | | | | |
| Kitchen utensils | | | 515 | | | | | |
| Jewelry (incl. watches) | | | 516 | | | | | |

**1995 NEPAL LIVING STANDARDS SURVEY (NLSS) STATA CODE**

**PROGRAM 4:**

```
* This program computes a consumption value for durables

***********************************************
*                                             *
*            Durables consumption             *
*                                             *
***********************************************

use data\sect06c

gen number=v06c02
gen    age=v06c03
gen oldval=v06c05
gen curval=v06c06

* update old value
gen presval=oldval*number if age==0
replace presval=oldval*1.08*number if age== 1
replace presval=oldval*1.17*number if age== 2
replace presval=oldval*1.27*number if age== 3
replace presval=oldval*1.39*number if age== 4
replace presval=oldval*1.68*number if age== 5
replace presval=oldval*1.84*number if age== 6
replace presval=oldval*2.05*number if age== 7
replace presval=oldval*2.18*number if age== 8
replace presval=oldval*2.42*number if age== 9
replace presval=oldval*2.75*number if age==10
replace presval=oldval*3.31*number if age>=11

gen deprate=1-(curval/presval)^(1/age)
sum deprate, d
sort durbcode
egen meddepr=median(deprate), by(durbcode)
tab durbcode, summ(meddepr)
gen durables= (meddepr+0.01)*curval/(1-meddepr)
sort wwwhh durbcode
collapse (sum) durables, by(wwwhh)
keep wwwhh durables
label var durables "Durables consumption"
sort wwwhh
save consumption\durables, replace
```

**1995 NEPAL LIVING STANDARDS SURVEY (NLSS) STATA CODE**

**PROGRAM 5:**

```
* This file aggregates all the consumption expenses: food, non-food, housing
* durables and calculates total nominal consumption per household and per
* capita

*** FOOD

use data\hhlist, clear
keep wwwhh hhsize weight group urbrural
sort wwwhh
merge wwwhh using consumption\food
drop _merge
recode food .=0
sort wwwhh
save consumption\aggcons, replace

*** NON FOOD

merge wwwhh using consumption\educatn
drop _merge
recode educatn .=0
sort wwwhh

merge wwwhh using consumption\health
drop _merge
recode health .=0
sort wwwhh

merge wwwhh using consumption\nfood1
drop _merge
recode nfood1 .=0
sort wwwhh
save, replace

*** HOUSING

merge wwwhh using consumption\hhrent
drop _merge
recode hhrent .=0
sort wwwhh

merge wwwhh using consumption\utility
drop _merge
recode utility .=0
sort wwwhh
save, replace

*** DURABLES

merge wwwhh using consumption\durables
drop _merge
recode durables .=0
sort wwwhh
save, replace

*** PUT ALL THE EXPENSES TOGETHER

gen totcons= food+ nfood1+ tobacco+ educatn+ durables+ hhrent+ utility
label var totcons "Total household consumption"
gen pcapcons = totcons/hhsize
label var pcapcons "Per-capita annual consumption"
sort wwwhh
```

```
save, replace

* generating main shares
gen foodp=purchase
recode foodp .=0
egen foodh=rsum(hproduct inkind)
recode foodh .=0
gen nfood=tobacco+educatn+health+nfood1
gen housecon=hhrent+utility
gen foodpsh=foodp/totcons
gen foodhsh=foodh/totcons
gen foodsh=food/totcons
gen educatsh=educatn/totcons
gen othnfosh=(nfood1+tobacco)/totcons
gen nfoodsh=nfood/totcons
gen housesh=housecon/totcons
gen rentsh= hhrent/totcons
gen utilsh= utility/totcons
gen durabsh=durables/totcons
gen weight1=totcons*weight
#delimit ;
collapse (mean) foodpsh foodhsh foodsh educatsh othnfosh nfoodsh
         housesh rentsh utilsh durabsh [weight=weight1];
#delimit cr
save consumption\totshare, replace
```

**1995 NEPAL LIVING STANDARDS SURVEY (NLSS) STATA CODE**

**PROGRAM 6:**

```
* This program generates a laspeyres regional price index using information on
* food prices and housing prices

***********************************************
*                                             *
*             LASPEYRES PRICE INDEX           *
*                                             *
***********************************************

***------------ FOOD PRICE INDEX ---------------***

* preparing weights

use data\hhlist, clear
keep wwwhh weight
gen sumcode=1
collapse (sum) sweight=weight, by(sumcode)
sort sumcode
save consumption\sweight, replace

* generating prices per standard units

use data\sect05, clear
sort wwwhh
merge wwwhh using data\group
drop _merge

* Eliminating items for which we do not have information on quantities
drop if fooditm==018. | fooditm==025. | fooditm==026. | fooditm==036.
drop if fooditm==044. | fooditm==055. | fooditm==056. | fooditm==067.
drop if fooditm==068. | fooditm==075. | fooditm==082. | fooditm==083.
drop if fooditm==084. | fooditm==085. | fooditm==086. | fooditm==094.
drop if fooditm==103. | fooditm==104. | fooditm==111. | fooditm==112.
drop if fooditm==113. | fooditm==114. | fooditm==124. | fooditm==131.
drop if fooditm==132. | fooditm==102. | fooditm==033.
drop if fooditm==121. | fooditm==122. | fooditm==123.

* Converting all purchased quantities into grams
gen     gramyrp =  v0503a* v0502*1000     if  v0503b==1
replace gramyrp =  v0503a* v0502          if  v0503b==2
replace gramyrp =  v0503a* v0502*37500    if  v0503b==3
replace gramyrp =  v0503a* v0502*1000     if  v0503b==4
replace gramyrp =  v0503a* v0502*72000    if  v0503b==5
replace gramyrp =  v0503a* v0502*3600     if  v0503b==6
replace gramyrp =  v0503a* v0502*1000/2.2 if  v0503b==7
replace gramyrp =  v0503a* v0502*3600     if  v0503b==8

* Converting eggs into grams (purchased)
replace gramyrp =  v0503a* v0502*60       if  v0503b== 9. & fooditm ==31
replace gramyrp =  v0503a* v0502*60*12    if  v0503b==10. & fooditm ==31
* Converting bananas into grams
replace gramyrp =  v0503a* v0502*127      if  v0503b== 9. & fooditm ==61
replace gramyrp =  v0503a* v0502*127*12   if  v0503b==10. & fooditm ==61
* Converting pineapples into grams
replace gramyrp =  v0503a* v0502*500      if  v0503b== 9. & fooditm ==65
replace gramyrp =  v0503a* v0502*500*12   if  v0503b==10. & fooditm ==65
* Converting papayas into grams
replace gramyrp =  v0503a* v0502*500      if  v0503b== 9. & fooditm ==66
replace gramyrp =  v0503a* v0502*500*12   if  v0503b==10. & fooditm ==66

drop if gramyrp==0 | gramyrp==.
```

```
* Converting home-produced food quantities into grams
gen     gramyrh =  v0506a* v0505*1000     if  v0506b==1
replace gramyrh =  v0506a* v0505          if  v0506b==2
replace gramyrh =  v0506a* v0505*37500    if  v0506b==3
replace gramyrh =  v0506a* v0505*1000     if  v0506b==4
replace gramyrh =  v0506a* v0505*72000    if  v0506b==5
replace gramyrh =  v0506a* v0505*3600     if  v0506b==6
replace gramyrh =  v0506a* v0505*1000/2.2 if  v0506b==7
replace gramyrh =  v0506a* v0505*3600     if  v0506b==8

* Converting eggs into grams (home-produced)
replace gramyrh =  v0506a* v0505*60       if  v0506b== 9 & fooditm ==31
replace gramyrh =  v0506a* v0505*60*12    if  v0506b==10 & fooditm ==31
* Converting bananas into grams
replace gramyrh =  v0506a* v0505*127      if  v0506b== 9 & fooditm ==61
replace gramyrh =  v0506a* v0505*127*12   if  v0506b==10 & fooditm ==61
* Converting pineapples into grams
replace gramyrh =  v0506a* v0505*500      if  v0506b== 9 & fooditm ==65
replace gramyrh =  v0506a* v0505*500*12   if  v0506b==10 & fooditm ==65
* Converting papayas into grams
replace gramyrh =  v0506a* v0505*500      if  v0506b== 9 & fooditm ==66
replace gramyrh =  v0506a* v0505*500*12   if  v0506b==10 & fooditm ==66

egen gramy=rsum(gramyrp gramyrh)
drop if gramy==0 | gramy==.

* Calculating an average price per gram
gen value = v0502*v0504
gen price = value/gramyrp
* Setting extreme values in price to missing
egen avgprice = mean(price), by(fooditm group)
replace price=. if (price > 10*avgprice | price < 0.1*avgprice)
label var price "price per standard unit"
keep wwwhh fooditm gramy price group
sort wwwhh
merge wwwhh using data\hhlist
keep if _merge==3
drop _merge
gen pricew=price*weight
sort wwwhh fooditm
save consumption\fdprices, replace

* generating the average quantities to use as weights for the price index

gen q0=gramy*weight/hhsize
collapse (sum) q0, by(fooditm)
gen sumcode=1
sort sumcode
merge sumcode using consumption\sweight
drop _merge
replace q0=q0/sweight
label var q0 "average quantities"
sort fooditm
save consumption\q0, replace

use consumption\fdprices, clear
drop if pricew==. | pricew==0
sort wwwhh fooditm
collapse (sum) regprice=pricew sweight=weight, by(fooditm group)
replace regprice= regprice/sweight
* there may be some items in a particular region for which we have not
* prices. We need to exclude them
gen one=1
egen chk=sum(one), by(fooditm)
```

```
drop if chk<=5
drop one
save consumption\fdprices, replace

sort fooditm
merge fooditm using consumption\q0
keep if _merge==3
drop _merge
gen regexp=regprice*q0
label var regexp "regional expenditure for the same food basket"
save consumption\fdprices, replace

* Create food item shares
egen totfood=sum(regexp), by (group)
gen share=regexp/totfood
collapse (mean) share, by(fooditm)
save consumption\fshares, replace

use consumption\fdprices
collapse (sum) regexp, by(group)
egen avg=sum(regexp)/6
gen findex=regexp/avg
gen one=1
gen region=sum(one)
drop one
label define KathmOthurRwhilRehilRwterReter 1 Kathm 2 Othur 3 Rwhil 4 Rehil 5
Rwter 6 Reter
label values region KathmOthurRwhilRehilRwterReter
keep region findex
sort region
list findex
save consumption\findex, replace

***------------ HOUSING PRICE INDEX ---------------***

* Regional housing price index using the hedonic regression as the basis

use consumption\housing, clear
sort wwwhh
merge wwwhh using data\hhlist
drop _merge

* generating output that would help calculate the housing price index
#delimit ;
reg lnrent kathmand othurban rwhills rehills rwterai lnrooms lndwsize
    lnasset kitchen proad walls floor roof window water garbage toilet
    light telephon if lnrent> 0;
#delimit cr

replace lnrooms=ln(3) if lnrooms==.
replace lndwsize=ln(500) if lndwsize==.
recode lnasset  .=0
recode kitchen  .=0
recode proad .=0
recode walls .=0
recode floor .=0
recode roof .=0
recode window .=0
recode water .=0
recode garbage .=0
recode toilet .=0
recode light .=0
recode telephon .=0

#delimit ;
```

```
collapse (mean) lnrent kathmand othurban rwhills rehills rwterai (median)
    lnrooms lndwsize lnasset kitchen proad walls floor roof window water
    garbage toilet light telephon [weight=weight];
sum;
gen av_rent= _b[_cons]+kathmand*_b[kathmand]+othurban*_b[othurban]+
    rwhills*_b[rwhills]+rehills*_b[rehills]+rwterai*_b[rwterai]+
    lnrooms*_b[lnrooms]+lndwsize*_b[lndwsize]+lnasset*_b[lnasset]+
    kitchen*_b[kitchen]+proad*_b[proad]+walls*_b[walls]+floor*_b[floor]+
    roof*_b[roof]+window*_b[window]+water*_b[water]+garbage*_b[garbage]+
    toilet*_b[toilet]+light*_b[light]+telephon*_b[telephon];
gen reter_r=av_rent-kathmand*_b[kathmand]-othurban*_b[othurban]-
    rwhills*_b[rwhills]-rehills*_b[rehills]-rwterai*_b[rwterai];
#delimit cr
gen kathm_r=reter_r+_b[kathmand]
gen othur_r=reter_r+_b[othurban]
gen rwhil_r=reter_r+_b[rwhills]
gen rehil_r=reter_r+_b[rehills]
gen rwter_r=reter_r+_b[rwterai]

replace av_rent=exp(av_rent)
replace reter_r=exp(reter_r)
replace kathm_r=exp(kathm_r)
replace othur_r=exp(othur_r)
replace rwhil_r=exp(rwhil_r)
replace rehil_r=exp(rehil_r)
replace rwter_r=exp(rwter_r)

keep av_rent reter_r kathm_r othur_r rwhil_r rehil_r rwter_r
expand 6
gen one=1
gen region=sum(one)
drop one
label define KathmOthurRwhilRehilRwterReter 1 Kathm 2 Othur 3 Rwhil 4 Rehil 5
Rwter 6 Reter
label values region KathmOthurRwhilRehilRwterReter
gen hindex=kathm_r/av_rent in 1
replace hindex=othur_r/av_rent in 2
replace hindex=rwhil_r/av_rent in 3
replace hindex=rehil_r/av_rent in 4
replace hindex=rwter_r/av_rent in 5
replace hindex=reter_r/av_rent in 6
keep region hindex
sort region
save consumption\hindex, replace

***------------ TOTAL PRICE INDEX ---------------***

use consumption\totshare
expand 6
gen one=1
gen region=sum(one)
drop one
label define KathmOthurRwhilRehilRwterReter 1 Kathm 2 Othur 3 Rwhil 4 Rehil 5
Rwter 6 Reter
label values region KathmOthurRwhilRehilRwterReter
sort region
merge region using consumption\hindex
drop _merge
sort region
merge region using consumption\findex
drop _merge
* we have information on prices on some components only of the total
* expenditure. the food price index is therefore used as a proxy for all but
* rent prices
gen pindex=rentsh*hindex+(1-rentsh)*findex
```

```
list findex hindex pindex
keep region pindex
sort region
save consumption\pindex, replace

***------------ PRICE-ADJUSTED CONSUMPTION -------------***

use consumption\aggcons
gen region=group
label define KathmOthurRwhilRehilRwterReter 1 Kathm 2 Othur 3 Rwhil 4 Rehil 5
Rwter 6 Reter
label values region KathmOthurRwhilRehilRwterReter
sort region
merge region using consumption\pindex
drop _merge
gen rtotcons=totcons/pindex
label var rtotcons "real household consumption"
gen rpccons=pcapcons/pindex
label var rpccons "real per capita consumption"
sort wwwhh
save consumption\raggcons, replace
```

## A2. PAASCHE PRICE INDEX: STATA CODE FOR NEPAL

```
* This program generates a paasche price index using data on food prices

***********************************************
*                                             *
*              PAASCHE PRICE INDEX            *
*                                             *
***********************************************


* 1.  Calculating the budget shares for each item in file01

use data\Sect05.dta, clear
*     Total consumption by household of each item
drop if fooditm>=120 & fooditm<=130
drop if fooditm>=130
gen purch =  v0502* v0504
gen hcons =  v0505* v0507
egen tcons = rsum( purch hcons v0508)
drop  purch hcons
label var tcons "Total consumption of item"
egen totcons = sum(tcons), by(wwwhh)
label var totcons "Total household consumption"
gen wi = tcons / totcons
label var wi "Budget share of item"
keep  wwwhh www fooditm wi
sort wwwhh fooditm
save file01, replace


* 2.  Calculating cluster-level median prices in file02

use data\Sect05.dta, clear
*     Identifying which code is reported most frequently for each food item
keep if  v0502 > 0 &  v0502~=. &  v0503a>0 &  v0503a~=. &  v0503b>0 &
v0503b<=10 &  v0504>0 &  v0504~=.
drop if fooditm== 10 | fooditm== 18 | fooditm== 20 | fooditm== 25
drop if fooditm== 26 | fooditm== 30 | fooditm== 36 | fooditm== 40
drop if fooditm== 44 | fooditm== 50 | fooditm== 55 | fooditm== 56
drop if fooditm== 60 | fooditm== 67 | fooditm== 68 | fooditm== 70
drop if fooditm== 75 | fooditm== 80 | (fooditm>=82 & fooditm<=90)
drop if fooditm== 94 | fooditm==100 | fooditm==103 | fooditm==104
drop if (fooditm>=110 & fooditm<=120) | fooditm>=124
collapse (count)  ncases=wwwhh, by( fooditm v0503b)
egen maxfreq = max( ncases), by(fooditm)
keep if  ncases== maxfreq
keep fooditm  v0503b
sort fooditm
ren  v0503b code
save temp1, replace
use data\Sect05.dta", clear
sort fooditm
merge fooditm using temp1
keep if _merge==3
drop _merge
erase temp1.dta
keep if  v0503b== code
drop if fooditm== 10 | fooditm== 18 | fooditm== 20 | fooditm== 25
drop if fooditm== 26 | fooditm== 30 | fooditm== 36 | fooditm== 40
drop if fooditm== 44 | fooditm== 50 | fooditm== 55 | fooditm== 56
drop if fooditm== 60 | fooditm== 67 | fooditm== 68 | fooditm== 70
drop if fooditm== 75 | fooditm== 80 | (fooditm>=82 & fooditm<=90)
```

```
drop if fooditm== 94 | fooditm==100 | fooditm==103 | fooditm==104
drop if (fooditm>=110 & fooditm<=120) | fooditm>=124
sort www
merge www using group
drop _merge
gen  ph =  v0504/ v0503a
egen pc = median(ph), by(www fooditm)
egen pg = median(ph), by(group fooditm)
egen p0 = median(ph), by(fooditm)
keep  wwwhh www fooditm ph pc pg p0
collapse (mean) pc pg p0, by(www fooditm)
sort www fooditm
label var pc "Cluster Price"
label var pg "Group Price"
label var p0 "Overall Price"
replace pc = pg if pc==.
replace pc = p0 if pc==.
drop if pc==. | pc==0
save file02, replace


* 3.  Food item price missing:  Replace with next level of aggregation
*      (Food Group) in file03

* Item within food group reported most frequently
use data\Sect05.dta, clear
keep if  v0502 > 0 &  v0502~=. &  v0503a>0 &  v0503a~=. &  v0503b>0 &
v0503b<=10 &  v0504>0 &  v0504~=.
gen foodgrp = int(fooditm/10)
collapse (count)  ncases=wwwhh, by(foodgrp fooditm)
egen maxfreq = max( ncases), by(foodgrp)
keep if  ncases== maxfreq
keep foodgrp fooditm
sort foodgrp
ren  fooditm code
save temp1, replace

use data\Sect05.dta", clear
keep wwwhh www fooditm
gen foodgrp = int(fooditm/10)
sort www fooditm
merge www fooditm using file02
drop _merge
label var foodgrp "Food Group"
sort foodgrp
merge foodgrp using temp1
drop _merge
erase temp1.dta
sort www
merge www using group
drop _merge

gen pcgrp = pc if fooditm==code
gen pggrp = pg if fooditm==code
gen p0grp = p0 if fooditm==code

egen pc2 = mean(pcgrp), by(www foodgrp)
egen pg2 = mean(pggrp), by(group foodgrp)
egen p02 = mean(p0grp), by(foodgrp)

replace pc = pc2 if pc==.
replace pc = pg2 if pc==.
replace pg = pg2 if pg==.
replace p0 = p02 if p0==.
```

```
keep wwwhh www fooditm foodgrp pc pg p0 group
sort wwwhh fooditm
save file03, replace


* 4.  Calculating the index itself
use file01
merge wwwhh fooditm using file03
drop _merge
sort wwwhh fooditm
gen pratio = pc/p0
label var pratio "Cluster Price / Overall Price"
gen lnprice = log(pratio)
label var lnprice "Log pratio"
gen lnpindex = wi*lnprice
collapse (sum) lnpindex, by(wwwhh)

gen pindex = exp(lnpindex)
drop lnpindex
label var pindex "Household Paasche Index"

save pindex, replace
```

## A3. DURABLES CONSUMPTION SUBCOMPONENT: STATA CODE FOR VIETNAM

```
*************************************************************
*                                                           *
*    OBJECTIVE: This program imputes a consumption          *
*    value from data on consumer durables (section 12c)     *
*                                                           *
*************************************************************

version 4.0
clear
set maxobs 130000

use data\sect12c

* CORRECTIONS
*-----consumer durable corrections
replace goodacy=82 if hid==25320 & goodcd==202
replace goodcv=. if hid==27902 & goodcd==202 & line==2
replace goodacy=78 if hid==20015 & goodcd==203
replace goodcv=1450 if hid==19616 & goodcd==203
replace goodcv=1100 if hid==20809 & goodcd==205
replace goodcv=800 if hid==24712 & goodcd==218 & line==10
replace goodbuy=110  if hid==20813 & goodcd==207
replace goodbuy=1000 if hid==14817 & goodcd==224
*---------------------------------------------------------------

save results\nfdcdurb, replace
clear

*---Depreciation rates calculations

* Age of each item calculated, taking into account the survey date

* Work out the date of the survey
set maxobs 5000
use data\sect00a
keep hid date1
gen svyyear=mod(date1,100)
gen svymonth=mod(int(date1/100),100)
tab svymonth svyyear,m
drop date1
sort hid
save results\svydate, replace
clear

set maxobs 32000

use results\nfdcdurb
sort hid
merge hid using results\svydate
tab _merge
drop if _merge<3

*---these cds are producer durables
drop if hid==8716 & goodcd==219
drop if hid==8714 & goodcd==219
drop if hid==13011 & goodcd==216
drop if hid==25501 & goodcd==216

*----calculations based on acquisitions since 1985-- they only consider
* durables acquired after 1986 because earlier inflation indices to update
* the purchase price do not exist.
```

```
keep if goodacy>85 & goodacy<94
drop if goodbuy==0 | goodbuy==.

*----generating an inflator variable to make all past values real : 1993=100

gen inflator=52423.1/321.1 if goodacy==86
replace inflator=52423.1/1514.4 if goodacy==87
replace inflator=52423.1/7181.7 if goodacy==88
replace inflator=52423.1/14059.7 if goodacy==89
replace inflator=52423.1/19177.9 if goodacy==90
replace inflator=52423.1/35038.2 if goodacy==91
replace inflator=52423.1/48240.7 if goodacy==92
replace inflator=52423.1/52423.1 if goodacy==93
gen realpurp=goodbuy*inflator

*---determining duration for which household has had cd
* 'hadformn' is the age of the durable expressed in months
replace goodacm=svymon if goodacm==.
gen hadformn=(svyyear-goodacy)*12 + (svymon-goodacm)
sum hadformn,d
l hid goodacy goodacm svyyear svymon if hadformn<0
replace hadformn=0 if hadformn<0

gen depnrate=1-((goodcv/realpurp)^(1/(hadformn/12)))
sum depnrate, d
tab goodcd, sum(depnrate)
sort goodcd

keep hid goodcd depnrate realpurp goodcv hadformn
save results\depnrate, replace

*-----calculate a median depreciation rate for each cd
* in order to minimize the influence of errors they prefer to take the
* median value instead of the average
collapse depnrate, by(goodcd) median(meddeprt)
sum meddeprt,d
sort goodcd
save results\meddepn, replace

*-------calculation of use value of consumer durable
use results\nfdcdurb
sort goodcd
merge goodcd using results\meddepn
drop _merge

*---these cds are producer durables
drop if hid==8716 & goodcd==219
drop if hid==8714 & goodcd==219
drop if hid==13011 & goodcd==216
drop if hid==25501 & goodcd==216

*-----assumes real interest rate of 5 %
* Originally there was a mistake in the formula, that has been corrected:
* goodcv*(1+meddeprt)*(0.05+meddeprt) is:
gen xnfd12m=goodcv*(0.05+meddeprt)/(1-meddeprt)
sum xnfd12m,d

rename goodcd expcode
keep hid expcode xnfd12m

collapse xnfd12m, by(hid) sum(totnfdx2)
sum totnfdx2,d
label variable totnfdx2 "Consumer durable - use value"
sort hid
save results\totnfdx2, replace
```

## A4. DURABLES CONSUMPTION SUBCOMPONENT: SPSS CODE FOR PANAMA

```
** This program calculates a flow of services from consumer durables **.

** Open the file with the information on consumer durables **.
get file ’c:\mecovi\data\equipo.sav’.

** select the households with have complete information.
sele if (estado=0).
execute.

** Run a frequency of the variables used to see the range of values.
** check if they have missing or extreme values.
freq f1 f2 f3 f4.

* f1 do or do not have the durable good?.
* f2 how many?.
* f3 age of the durable good?.
* f4 purchase price of the durable good?.

** If age or value is missing, replace with mean value for area and type of good.
sort cases by area equipo.

** generate a file with average age and value by geographic area.
aggregate outfile ’c:\mecovi\salman\aggr.sav’
  /break area equipo
  /edad.m = mean(f3)/v.dura.m = mean(f4) .
execute.

match file/file*/
  table ’c:\mecovi\salman\aggr.sav’/
  by area equipo.
execute.

freq f1 f2 f3 f4.

sort cases by equipo f3.

** generate a file with average values for each good by age.
aggregate outfile ’c:\mecovi\salman\aggr.sav’/
  break equipo f3/
  v.du.a.m = MEAN(f4).
execute.

match files/file*/
  table ’c:\mecovi\salman\aggr.sav’/
  by equipo f3.
execute.

** recode missing values with –1.
recode f4  (miss=-1).
execute.
if (f4 =  - 1 & v.du.a.m > 0) f4 = v.du.a.m .
execute.

** still have 50 cases with missing values – for these, use the average values
by geographic region.
if (f4 =  - 1 & v.dura.m > 0) f4 = v.dura.m .
execute.

freq f4.

recode f4
```

```
  (0 thru 50=1)  (50.00000001 thru 100=2)  (100.000001 thru 500=3)
  (500.000001 thru Highest=4)  into grupo.va .
execute.
variable label grupo.va ’Grouped value of durable good’.

sort cases by equipo (A) grupo.va (A) .

** generate a file with average values.
aggregate outfile ’c:\mecovi\salman\aggr.sav’/
  break equipo grupo.va/
  edad.g ’Age by group’ = MEAN(f3).
execute.

match files/file */
  table ’c:\mecovi\salman\aggr.sav’/
  by equipo grupo.va.
execute.

recode f3  (miss=-1)  .
execute.

if (f3 =  - 1 & edad.g > 0) f3 = edad.g .
execute.

** Average age for cars (5.8) and boats (4.2).
** do not appear to be representative of values we’d expect for Panama
** instead, we used Car=20, boats=15.

if (equipo = 21) edad.m = 10 .
execute.
if (equipo = 22) edad.m = 7.5 .
execute.

** Calculate total remaining useful life of each durable good.
compute edad.que = (edad.m * 2) - f3.
execute.
variable labels edad.que 'Total remaining life of durable good' .

** Assign a minimum useful life of 2 years.
recode edad.que  (lowest thru 2=2)  .
execute.

** Assign a minimum useful life of 4 years for all goods with a value > $5,000.
do if (f4 >= 5000) .
recode edad.que  (Lowest thru 4=4)  .
end if.
execute.

** In 4 cases, change minimum with 4 years.

compute V.USO = f4 / edad.que .
execute.

recode f2 (9=1) (sysmis=1) .
execute.
compute v.equipo = f2 * v.uso .
execute.
variable label v.equipo 'Valor de uso anual de equipos' .

sort cases by form.

** Generate an output file with ID code of household and consumption value.
aggregate outfile 'c:\mecovi\salman\gasto5.sav'/presort/break  form/
  v_equipo 'Use value of durable goods' = sum(v.equipo).
```

**A5. DURABLES CONSUMPTION SUBCOMPONENT: STATA CODE FOR KYRGYZ REPUBLIC**

```
************************************************
*                                              *
*             Durables consumption             *
*                                              *
************************************************

use fall96\sect12c, clear
collapse (sum) v12c04, by(hhid)
* Assuming a i=10% to attribute a consumption flow to stock of durables
gen durables = 0.1*v12c04
recode durables .=0
label var durables "Annual durables consumption"
keep hhid durables
sort hhid durables
save results\durables, replace
```

**A6. HOUSING CONSUMPTION SUBCOMPONENT: STATA CODE FOR SOUTH AFRICA**

```
#delimit ;
* The calculation of the housing cost is obtained using the following
  measurements:
  1) The actual value of the rent paid or an estimate of the
     the rental value of the house if it is provided for free
     by sombody else.
  2) Estimate of the rental value based on the ratio of property value
     and rental value in the same area for all the people that report
     the resale value of their homes.
  3) Estimate of the value of the homes for all the poeple that do not
     provide the cost of rent nor the value of their homes, so as to use
     the same ratio to estimate the rental value.;
version 4.0;
clear;
log using results\clcexp04,replace;
set log linesize 200;
*************************************************************;
*                                                           *;
*    Name    : CLCEXP04.DO              V : 01              *;
*    Date    : AUGUST 5, 1994                               *;
*    Infile  : S4_HSV1,STRATA2                              *;
*    Outfile : HHEXP04                                      *;
*                                                           *;
*    OBJECTIVE: Calculate Actual and Inputed Housing        *;
*               Expenditure                                 *;
*                                                           *;
*************************************************************;
set more 1;

**  Get the files                **;
use data\s4_hdef;
keep hhid;
sort hhid;
merge hhid using data\s4_hsv1;
tab _merge;
drop _merge;
sort hhid;
merge hhid using data\strata2;
tab _merge;
drop _merge;
sort hhid;
gen clustnum=int(hhid/1000);

***   ACTUAL OR ESTIMATES RENTAL EXPENDITURE  (use values above R10) ***;
gen rentexp=rent_a if rent_a>10;
replace rentexp=rent_m if rent_m>10 & rentexp==.;
lab var rentexp "Actual Rental Expenses";
gen int marker04=0;
lab var marker04 "Marker";
replace marker04=1 if rentexp>0 & rentexp~=. & rent_a>10; *Have actual rent ;
replace marker04=2 if rentexp>0 & rentexp~=. & rent_m>10; *Have market rent ;
replace marker04=3 if marker04==0 & sale>0 & sale~=.;     *Have Value;
replace rooms_to=. if rooms_to<0;                       ** To avoid negatives;

**   ESTIMATE THE VALUE OF THE HOUSE FOR ALL THE PEOPLE WITH NO VALUE
**   OR NO RENT AND NO VALUE;
** Get number of rooms for those with missing - use cluster and race;
egen mdroom=median(rooms_to), by(clust race);
replace rooms_t=mdroom if rooms_t==. & mdroom>0 & mdroom~=.;
sort hhid;
save stex01,replace;
```

```
** Get the median value by cluster   **;
gen valroom=sale_val/rooms_to;
egen mdvalrm=median(valroom) if valroom>0, by(clust);
collapse mdvalrm, max(mdvalrm) by(clust);
des;
sum;
sort clust;
save stex02,replace;

** By New province metro and race   **;
use stex01;
gen valroom=sale_val/rooms_to;
egen mdvalrm2=median(valroom) if valroom>0, by(newp metro race);
collapse mdvalrm2, max(mdvalrm2) by(newp metro race);
des;
sum;
sort newp metro race;
save stex03,replace;

**  Put the median values back in the file **;
use stex01;
keep hhid clust marker04 rooms_to newp metro race;
sort clust;
merge clust using stex02;
tab _merge;
drop _merge;
sort newp metro race;
merge newp metro race using stex03;
tab _merge;
drop _merge;
gen mdval=mdvalrm*rooms_to;
replace mdval=mdvalrm2*rooms_to if mdval==.;
des;
sum;
keep if marker04==0;
sort hhid;
save stex04,replace;
use stex01;
merge hhid using stex04;
tab _merge;
drop _merge;
replace sale=mdval if marker04==0;
tab newpro if marker04==0, sum(sale);
tab newpro if marker04==1, sum(sale);
tab newpro if marker04==2, sum(sale);
tab newpro if marker04==3, sum(sale);
replace marker04=4 if marker04==0 & sale>0 & sale~=.;
lab def mar 0 "Miss"
            1 "Rent_a"
            2 "Rent_m"
            3 "Val "
            4 "No Re/Val"
            5 "Impute";
lab val marker04 mar;
save stex01,replace;

***  Check the ratio: value to rental by province metro and race  **;
use stex01;
egen valmed = median(sale_val) if sale_val>0 , by(newpr metro race);
egen rentmed= median(rentexp)  if rentexp>0  , by(newpr metro race);
egen numrent= count(rentexp)   if rentexp>0  , by(newpr metro race);
egen numval = count(sale_val)  if sale_val>0 , by(newpr metro race);
collapse rentmed valmed numrent numval ,
         max(rentmed valmed numrent numval) by(newpr metro race);
gen ratio = rent*1200/val if rent>0 & val>0;
```

```
egen mdratio=median(ratio), by(metro race);
collapse mdratio , max(mdratio) by(metro race);
des;
list;
save stex05,replace;

*** CALCULATE IMPUTED VALUE OF RENT USING REPORTED AND ESTIMATED SALE  VALUE OF
THE PROPERTY AND RENTAL RATIO BY LOCATION AND RACE;
use stex01;
sort metro race;
merge metro race using stex05;
tab _merge;
drop _merge;
gen rentimp=sale*mdratio/1200 ;
replace rentimp=. if marker04==1 | marker04==2;
lab var rentimp "Imputed Rental Expenses";

*** REPLACE REMANING VALUES WITH CLUSTER MEDIANS - In three clusters
    they are still missing because nobody has a value of the house
    in which they are, because everybody else is renting.  ;
gen rentroom=rentexp/rooms_t;
egen mdrtrom=median(rentroom), by(clust race);
replace mdrtrom = 20 if clust==40 &
                        mdrtrom==. ; * Median for 2 Coloured in African area;
gen mdrt=mdrtrom*rooms_t;
replace marker04=5 if marker04==0 & mdrt>0 & mdrt~=.;
replace rentimp=mdrt if marker04==5;

**  SAVE THE RESULTS IN A FILE  **;
keep hhid rentexp rentimp marker04;
lab data "Rental Expenditure";
egen mxtrent=rsum(rentimp rentexp);
replace mxtrent=. if marker04==0;
lab var mxtrent "Total Housing Expenditure";
sort hhid;
des;
sum;
save results\hhexp04,replace;

** DELETE UNECESSARY FILES   **;
!del stex01.dta;
!del stex02.dta;
!del stex03.dta;
!del stex04.dta;
!del stex05.dta;

log close;
```

## A7. HOUSING CONSUMPTION SUBCOMPONENT: STATA CODE FOR VIETNAM

```
**************************************************************
*                                                            *
*               OBJECTIVE: calculate rents                   *
*                                                            *
**************************************************************

* This program inputes rents. The huge majority of people live in their
* own dwelling (94%) and only 17 out of 4800 households rent their dwlling
* from private persons.  The value of housing consumption taken to be
* 3% of the current value of the house
* The housing value is predicted with a regression of housing value on
* various housing characteristics.

version 4.0
clear
set matsize 150
set maxobs 5000

use data\sect06

*-----region & location variables

*----commune number used to distinguish urban and rural areas, specific
* cities and major regions
gen cum=round((int(hid/100)/2),1)
replace cum=68 if cum==151
label variable cum "Commune number"

*----dummy variables for Hanoi & Saigon
gen hanoi=cum>123 & cum<127
gen saigon=cum>138 & cum<145

gen byte urban=0 if 1<=cum&cum<=120
replace urban=1 if 121<=cum&cum<=150

gen int region=1 if (cum>=1&cum<=12)|(cum>=22&cum<=28)
replace region=1 if (cum>=121&cum<=123)|cum==127
replace region=2 if (cum>=13&cum<=21)|(cum>=29&cum<=51)
replace region=2 if cum>=124&cum<=130&cum~=127
replace region=3 if cum>=52&cum<=69
replace region=3 if cum==131|cum==132
replace region=4 if (cum>=70&cum<=79&cum~=73)|(cum>=82&cum<=84)
replace region=4 if cum>=133&cum<=137
replace region=5 if cum==73|cum==80|cum==81|cum==85
replace region=6 if (cum>=86&cum<=89)|(cum>=92&cum<=97)
replace region=6 if cum>=139&cum<=145
replace region=7 if cum==90|cum==91|(cum>=98&cum<=120)
replace region=7 if cum==138|(cum>=146&cum<=150)

label define region 1 "NU" 2 "RR" 3 "NC" 4 "NC" 5 "CH" 6 "SE" 7 "MD"
label values region region
label define urban 0 "Rural" 1 "Urban"
label values urban urban

tab region, gen(region)

* ----Housing characteristics

gen electrcy=light==1

tab bultyear, gen(dwelage)
tab dwater, gen(dh2osrc)
```

```
tab walls, gen(walls)
tab floor, gen(floor)
tab roof, gen(roof)

*-----dummy variables for repair condition of dwelling
egen repair=group(dwlwcond dwlfcond dwlrcond)
#delimit ;
label define repair 1 "All3" 2 "W+F" 3 "W+R" 4 "Wall" 5 "F+R"
                    6 "Floor" 7 "Roof" 8 "AllOk";
#delimit cr
label values repair repair

*----recode some categories to create dummy variables
replace light=5 if light==2
replace window=5 if window==3

tab door, gen(door)
tab window, gen(window)
tab toilet, gen(toilet)
tab repair, gen(repair)

gen roomgp=rooms
replace roomgp=5 if rooms>5
label variable roomgp "Room groups: > 5=5"
tab roomgp, gen(roomgp)

gen loghval=log(saleval)

#delimit ;
stepwise loghval dwelage2-dwelage6 roomgp2-roomgp5 electrcy
         dh2osrc1-dh2osrc7 walls1-walls8 floor1-floor7 roof1-roof7
         toilet2-toilet5 window2-window5 door2-door4 repair1-repair7
         region2-region7 urban hanoi saigon uar lar, backward;
#delimit cr

predict lnhvalht
gen houseval=exp(lnhvalht)
replace houseval = saleval if hid == 27815  /* house with fifteen rooms */
label variable houseval "Predicted house value"

* estimated rental expenditures - two scenarios: 2 and 3 percent (annually)
* of predicted sale value of dwelling - multiplied by 1000 because sale
* value info in millions of dongs. For the consumption aggregate the 3%
* will be used.

gen rentexp2=0.02*houseval*1000
gen rentexp3=0.03*houseval*1000
label variable rentexp2 "Imputed rent - interest rate=2%"
label variable rentexp3 "Imputed rent - interest rate=3%"
sum rentexp*, d

keep hid rentexp* saleval houseval region urban cum rentby vrentc rentuc
replace vrentc = vrentc * 2 if rentuc == 7
replace vrentc = vrentc * 4 if rentuc == 6
replace vrentc = vrentc * 12 if rentuc == 5
gen ratio_rs = vrentc/(1000 * saleval) if rentby == 3
label variable ratio_rs "Rent/Sale if rented from private agency"
tab ratio_rs
drop rentby vrentc rentuc ratio_rs
sort hid
save results\rentexp, replace
```