Review of Income and Wealth
Series 52, Number 3, September 2006

TESTING POVERTY LINES

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In theory, a poverty line can be defined as the cost of a common (inter-personally comparable) utility level across a population. But how can one know if this holds in practice? For groups sharing common consumption needs but facing different prices, the theory of revealed preference can be used to derive testable implications of utility consistency knowing only the "poverty bundles" and their prices. Heterogeneity in needs calls for extra information. We argue that subjective welfare data offer a credible means of testing utility consistency across different needs groups. A case study of Russia's official poverty lines shows how revealed preference tests can be used in conjunction with qualitative information on needs heterogeneity. The results lead us to question the utility consistency of Russia's official poverty lines.

1. INTRODUCTION

Poverty lines are widely used in constructing "poverty profiles," showing how a measure of poverty varies across sub-groups of a population, such as geographic areas. Various methods are used to set poverty lines and the methodological choices can matter. For example, a study for Indonesia found virtually zero rank correlation between the regional poverty measures implied by two common methods of setting poverty lines (Ravallion and Bidani, 1994). This suggests that it is important to probe critically into the methods used to set poverty lines in practice.

One might argue that poverty lines are inherently normative concepts, which must be judged by ethical criteria that are wholly outside economics. While we agree that normative judgments should and do enter the process of setting poverty lines, we contend in this paper that they are not solely normative. Poverty lines can be viewed as deflators for cost-of-living differences. They are deflators that are anchored to a reference standard of living, above which one is not deemed to be poor, though the fact that they depend on the choice of that reference is a feature they share with other deflators; see, for example, the discussion of cost-of-living indices in Deaton and Muellbauer (1980). Normative judgments can help inform the choice of that reference. They can also help in assessing how differences in non-market characteristics of individuals should enter into the assessment of their welfare and (hence) what level of income they need to assure that the reference

Note: The authors are grateful to the two anonymous referees for helpful comments. These are the views of the authors, and need not reflect those of the World Bank or any affiliated organization.

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level of welfare is achieved. However, that still leaves scope for testing poverty lines against non-normative data.

We start from the premise that the poverty line for each sub-group in the population should be the cost of a common (inter-personally comparable) level of welfare. We take "welfare" to be assessed by a utility function defined on commodities, though we allow that function to vary between at least some groups of people, reflecting differences in their consumption needs. By this view, an income poverty line is interpreted as the money metric of the minimum critical level of utility needed to not be poor. We call this "utility consistency."[1]

The paper outlines an approach to testing the utility consistency of poverty lines. We first show that Samuelson's (1938) theory of revealed preference can be readily used to derive testable necessary conditions for utility consistency across those groups that are deemed to share common consumption needs. All that is required is the set of "poverty bundles" and their prices. However, poverty lines will naturally reflect differing consumption needs as well as differing prices. Then the information base for testing poverty lines must be expanded; it is not sufficient to just know quantities and prices. We argue that past work using self-assessments of subjective economic welfare offer a promising route for testing consistency across different needs groups.

As a case study, we apply these ideas to an assessment of Russia's official poverty lines. Russia's striking climatic differences across regions suggest that the same consumption bundle is unlikely to yield the same utility. (Large regions of Russia have average annual temperatures well below freezing, while other regions have moderate northern-European climates.) By implication, poverty lines should have higher value (assessed by a quantity index) in colder climates. That is what we find in the data. However, we also find violations of revealed preference criteria that cannot be easily ascribed to the sources of needs heterogeneity invoked explicitly in setting the poverty bundles. Nor do the differences across needs groups accord with self-rated perceptions of economic welfare. We conclude that there are latent utility inconsistencies and we speculate on their origin.

Section 2 defines more precisely what we mean by "utility consistent" poverty lines. Section 3 develops our revealed-preference tests, while Section 4 reviews alternative approaches in the literature for dealing with heterogeneity in consumption needs. We then provide a case study based on Russia's official poverty lines; Section 5 describes our data, while Section 6 presents our results. Conclusions can be found in Section 7.

2. Utility Consistent Poverty Lines in Theory

We define a poverty line as the money needed by some specific group of people within a population to achieve the minimum level of "well-being" that is required to not be deemed "poor." Thus everyone at the poverty line (no matter what group they happen to belong) is deemed to be equally badly off, and all those below the line are worse off than all those above it.

[1]Functioning-based concepts of well-being (as in Sen, 1985) are sometimes viewed as an alternative theoretical foundation for poverty measurement. Elsewhere we argue utility consistency can be interpreted within a functioning-based approach if one so wishes (Ravallion and Lokshin, 2005).

To formalize this approach to defining poverty lines, let there be N mutually exclusive groups indexed $j = 1, \ldots N$ such that all individuals within a given group share the same utility function defined over commodities and face the same prices. An interpersonally comparable utility function, $u_j(q)$, gives the utility in group j of an m-vector q of commodities. We say that two individuals have the same "consumption needs" if they are assigned the same utility when their consumption vector is the same. Each household chooses its consumption to maximize utility given its (unique) group assignment. We make the standard assumption that each $u_j(.)$ traces out strictly convex indifference curves (though this can be weakened somewhat).

These utility functions serve two roles in our analysis: firstly $u_j(.)$ reproduces the ordinal preferences of people in group j and, secondly, the $u_j(.)$ for $j = 1, \ldots N$ reflect the inter-group differences in consumption needs. In the first role, $u_j(q)$ is simply a representation of the ordinal preferences of group j. However, the second role requires cardinal comparability, which will call for external observer judgment. Those in charge of setting poverty lines will naturally make such judgments. For example, a defensible view might be that people in a relatively cold climate require that more is spent on heating and clothing (and possibly food). Another possible example is that between-group differences in average consumptions may entail that consumption needs are deemed to vary, to reflect differences in relative deprivation.[2]

While (by construction) both prices and needs are constant within a group, needs may be constant between different groups facing different prices. In particular, we say that needs are constant ("homogeneous") between groups i and j if $u_i(q) = u_j(q)$. Without loss of generality we can say that there are n sets within which needs are the same, and these sets are indexed $k = 1, \ldots, n$ with $1 \leq n \leq N$ and the k-th set of groups within which needs are constant is denoted $\boldsymbol{N}_k$ (for the k-th "needs set"). Of course it cannot be presumed that $n = 1$. We refer to this potential variation in utility functions across groups as "needs heterogeneity."

The utility-consistent poverty line is defined as the minimum cost of the common utility level at the prices facing each group. The consumer's expenditure function is $e_j(p_j, u)$, giving the minimum cost of utility u in group j when facing the m-vector of prices p_j.[3] Let u_z denote the minimum utility level deemed to be needed to escape poverty. Consistency requires that this is a constant across all j. Thus the utility-consistent poverty lines are given by:

$$z_j = e_j\left(p_j, u_z\right) \quad \text{for} \quad j = 1, \ldots, N \tag{1}$$

When actual expenditure on consumption is deflated using the set of utility-consistent poverty lines defined by (1), we obtain a welfare metric with a number

[2]A "relative poverty line" is interpretable as the money metric of welfare when the latter depends on own consumption and relative consumption (Ravallion, 1998). Methods of setting relative poverty lines are discussed in (*inter alia*) Hagenaars and van Praag (1985), Ravallion (1998) and Madden (2000).

[3]In principle one can allow for other shift variables in the expenditure function associated with individual characteristics. However, the present exposition is served adequately by embedding all such differences into the definition of the N groups.

of desirable theoretical properties for policy analysis, as shown in Blackorby and Donaldson (1987).

How does all this compare to common practice in setting poverty lines? One of the most common methods of setting poverty lines in practice is the "Cost of Basic Needs" (CBN) method.[4] This stipulates a consumption bundle deemed to be adequate for "basic consumption needs," and then estimates its cost for each of the groups being compared in the poverty profile. This is the approach of Rowntree in his seminal study of poverty in York, England, in 1899, and there have been numerous examples since, including the official poverty lines for the U.S.[5] The poverty bundle is typically anchored to food-energy requirements consistently with common diets in the specific context. However, allowances for non-food goods are also included, to assure that basic non-nutritional needs are assured. (We give an example of how CBN poverty lines are constructed in Section 5.)

Superficially, the CBN method looks like a more promising route to utility-consistent poverty lines than other methods often used in practice (Ravallion, 1998; Ravallion and Lokshin, 2005). The CBN poverty line can be written as the expenditure needed to achieve a specific bundle of goods. Similarly, the "ideal" utility-consistent poverty line in equation (1) can be written:

$$z_j^u = p_j q_j\left(p_j, u_z\right) \tag{2}$$

where $q_j(p_j,u_z)$ is the utility-compensated (Hicksian) demand functions (which minimizes the cost of reaching u_z when facing prices p_j. The CBN method will be utility consistent *if* the right bundle is used, corresponding to the relevant points on the utility-compensated demand functions. However, there is nothing to guarantee that the bundles built into CBN poverty lines lie on the compensated demand functions, at the (common) reference level of utility.

Thus it is important to have some way of testing a set of CBN poverty bundles. Of course, if we knew the utility functions, $u_j(q)$, $j = 1, \ldots N$, the test would be straightforward. In practice, however, that is not likely to be the case. Our information typically includes the poverty bundles and their prices but not the utility functions. In the next section we outline one approach to testing poverty lines based on this limited information. However, as we will argue, price and quantity information alone may well have rather limited power for testing poverty lines. It can be very useful to also have at least qualitative information on the sources of needs heterogeneity that are deemed to be relevant on *a priori* grounds to welfare at the poverty line.

3. Revealed Preference Tests of Poverty Lines Within the Same Needs Group

In this section we confine attention to comparisons within a given needs group, defined as a group of people sharing common preferences over commodi-

[4]For overviews of this method and alternatives found in practice, see Ravallion (1994, 1998).
[5]See Orshansky (1963) and Citro and Michael (1995).

ties. (The next section considers differences in needs.) We assume that data are available on both the quantities in the poverty bundle and the corresponding prices.[6] Let $q_j^z = (q_j^{z1}, \ldots, q_j^{zm})$ denote the m-vector of commodities that constitute the CBN poverty bundle for groups $j = 1, \ldots N$. The corresponding price vector is p_j and the poverty line in group j is $z_j = p_j q_j^z$. Let $r_j = (p_j^1/z_j, \ldots, p_j^m/z_j)$ denote the vector of price relatives and let $\boldsymbol{P} \equiv \{r_j, j = 1, \ldots, N\}$ denote the set of all price relatives.

We define the *nxn quantity-index matrix* $\boldsymbol{Q}$ for which the j-th row and k-th column give the cost of j's poverty bundle when valued at k's price relatives:[7]

$$Q_{jk} \equiv r_j q_k^z = \frac{p_j q_k^z}{p_j q_j^z} \tag{3}$$

For example, in the case of $n = 2$, the matrix is:

$$\boldsymbol{Q} = \begin{bmatrix} 1 & r_1 q_2^z \\ r_2 q_1^z & 1 \end{bmatrix} \tag{4}$$

We also define $\boldsymbol{Q}_i$ as the matrix of quantity indices corresponding to the groups in the set $\boldsymbol{N}_i$.

The $\boldsymbol{Q}$ matrix can be used to compare poverty bundles across groups; the higher Q_{jk} the higher the value of the poverty bundle for group k when judged by group j's prices. We will say that the bundle for region k is "unconditionally higher" than the bundle for h if $Q_{jk} \geq Q_{jh}$ for all r_j in $\boldsymbol{P}$. This means that all elements of column h are greater than the corresponding elements of the k-th column. (Of course, there is no guarantee that such a ranking is possible; that is an empirical question.) To provide a summary statistic for the value of the poverty line we can calculate the simple mean quantity index formed by taking the column totals of the $\boldsymbol{Q}$ matrix; we write this index as $\bar{Q}_j = \Sigma_{i=1}^n Q_{ij}/n$. Finding that $\bar{Q}_j > \bar{Q}_k$ implies that bundle j dominates k at least partially (for some price relatives in $\boldsymbol{P}$), though (of course) not necessarily fully.

Can we determine whether a set of CBN poverty lines are utility consistent based on the $\boldsymbol{Q}$ matrix? Consider, two groups, A and B (urban and rural areas, say), each with a poverty line, which is the cost in each group of pre-specified bundles of goods specific to each group. Our definition of consistency requires that these two bundles yield the same utility. If needs are identical in A and B then there is a straightforward revealed preference test. This requires that the poverty line for A is no greater than the cost of B's bundle for a member of group A, for otherwise the bundle in B is affordable when A was chosen, implying that A is preferred. But then the two bundles cannot yield the same utility (judged by the common preferences). Similarly, the group B poverty line cannot be greater than the cost in that

[6]We assume that there are no comparability problems between groups arising from the use of different surveys or different data processing methods. Lanjouw and Lanjouw (2001) examine the implications for methods of setting poverty lines of differing consumption aggregates arising from differences between the surveys.

[7]On quantity indices, see Deaton and Muellbauer (1980, section 7.2).

group of the bundle for A. If this test fails than we can reject consistency though passing the test does not assure consistency for all possible utility functions.

To outline our test in more formal terms, note first that if the poverty lines are utility consistent then (by definition):

$$u_j(q_j^z) = u_k(q_k^z) \tag{5}$$

for all (j, k) combinations in a given needs group. The testable implication of (1) and (5) is that $Q_{jk} \geq 1$ for all (j, k) combinations in $\boldsymbol{Q}_i$. To see why, suppose instead that $Q_{jh} < 1$ for some group h, i.e. $p_j q_h^z < p_j q_j^z$. Then the bundle q_h^z was affordable in group j with the expenditure required for obtaining q_j^z. However, for consistency we require that q_j^z is the utility-maximizing bundle for someone at the poverty line in group j (equation 1). Furthermore, given convex indifference curves, q_j^z is the unique such bundle. It follows that q_j^z must have been strictly preferred to q_h^z $\left(u_j(q_j^z)\right) > u_j(q_h^z)$ given that needs are constant, which contradicts utility consistency.

A number of further remarks can be made about our test:

(i) It is possible to find that $Q_{ij} \geq 1$ but $Q_{ji} < 1$ for an (i, j) pair in the same needs set. In other words, we may be unable to reject utility consistency between the bundles for groups i and j when assessed using i's price relatives, yet we can reject it when using j's. If we find that $Q_{ij} \geq 1$ but $Q_{ji} \geq 1$ we will say that the bundles i and j are *mutually consistent*.

(ii) Our test is necessary for utility consistency, but it is not sufficient. It is possible to find that $Q_{ij} \geq 1$ and yet bundles i and j do not yield the same utility when judged by i's needs. Figure 1 illustrates this point. Four bundles of two goods are identified. Point B represents the poverty bundle for region B, with the indifference curve indicated, while A, C and D are the bundles for three other regions. When assessed by region B's needs, we can reject consistency between A and B; bundle A must be on a lower indifference curve than B. However, we cannot reject consistency for C and D (as drawn, C and B are consistent, but we do not of course know the actual indifference curves in practice).

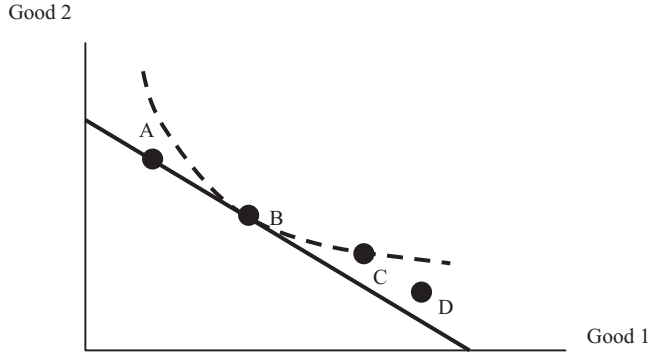

Figure 1. Consistency Test for Four Bundles

Note: Consistency with bundle A is rejected for B but the test is inconclusive for C and D without knowing needs.

(iii) This is a joint test of the two consistency requirements in (1) and (5), and if one fails to hold then the test loses all power to detect whether the other holds. For example, suppose that the bundle of goods on which a poverty line is based would not be chosen by someone at the poverty line income given the prevailing prices. Then it can still satisfy (5) even though our quantity index is less than unity.

(iv) If consistency is rejected, it is of interest to ask whether there is a set of scalar adjustments to the original poverty lines that will assure they pass our consistency tests. There is nothing to guarantee that such a set of scalar corrections exists; possibly the only way to pass the test is to redesign the original bundles. However, there is a straightforwardly testable necessary condition for the existence of a set of scalar corrections that will assure that our consistency test passes. To see what this entails, let k_j denote the scalar adjustment made to all the elements of the vector q_j^z and consider the case of $n = 2$ so the adjusted $\boldsymbol{Q}$ matrix is given by:

$$\begin{bmatrix} 1 & \dfrac{k_2 p_1 q_2^z}{k_1 p_1 q_1^z} \\ \dfrac{k_1 p_2 q_1^z}{k_2 p_2 q_2^z} & 1 \end{bmatrix}$$

If the scalar corrections k_1 and k_2 entail that our test is passed then it must be the case that:

$$\frac{p_1 q_1^z}{p_1 q_2^z} \leq \frac{k_2}{k_1} \leq \frac{p_2 q_1^z}{p_2 q_2^z}$$

This in turn implies that $Q_{12}Q_{21} = \left(r_2 q_1^z\right)\left(r_1 q_2^z\right) \geq 1$. In other words, a necessary condition for the existence of a set of scalar corrections to assure that our consistency test passes is that the product of the off-diagonal elements of the $\boldsymbol{Q}$ matrix cannot be less than unity. Extending this idea to the case of n groups, the necessary (but not sufficient) condition becomes that $Q_{ij}Q_{ji} \geq 1$ i.e. the product of the (i, j) and (j, i) mirror-opposite elements cannot be less than unity.

4. Testing Consistency Across Different Needs Groups

It is impossible to conclusively test utility consistency knowing *only* the poverty bundles and their prices. Between a group in the set $\boldsymbol{N}_i$ and one in $\boldsymbol{N}_k$ $(i \neq k)$, the poverty bundles can be utility consistent even when the revealed preference test fails given that the utility functions differ between the two groups. This echoes a generic identification problem in all welfare comparisons. The problem is that households can vary in characteristics (such as their location, size and demographic composition) that influence welfare in ways that are not evident in consumer demand behavior.

To see the problem in more formal terms, imagine that we have data on the quantities consumed at prevailing prices and total expenditures (y) for a sample of households spanning different groups. By econometric methods, we obtain empirical demand functions $\hat{q}_j(p_j,y)$ (incorporating a group effect on demand behavior) and we assume that these estimated functions satisfy the properties that allow us to integrate back to an (indirect) utility function $\hat{v}_j(p_j,y)$ with corresponding expenditure function $\hat{e}_j(p_j,u)$. It looks like we have solved the problem of setting poverty lines. However, there is a snag; if $\hat{v}_j(p_j,y)$ implies the demands $\hat{q}_j(p_j,y)$ then so does any monotonic increasing function of $\hat{v}_j(p_j,y)$. Thus we can simply scale up or down any of the derived group-specific empirical utility functions to obtain different poverty lines.

This is nothing more than an instance of a well-recognized problem of identifying the consumer's expenditure or utility functions from observed behavior when needs differ (Pollak and Wales, 1979; also see the discussions in Pollak, 1991, and Browning, 1992). The implication is that interpersonal welfare comparisons must inevitably bring other information into the picture to justify the judgments made about one group's consumption needs relative to another's. Again we see that the problem of testing poverty lines can be viewed as a special case of the more general problem of interpersonal welfare comparisons.

Two main approaches can be found in the literature on setting poverty lines that might be used for testing their utility consistency across different needs groups. The first is based on *nutritional requirements*. These stipulate food-energy intakes for maintaining bodily functions at rest and for supporting work; these can vary by age, gender and climate.[8] Only under the seemingly implausible assumption that utility depends *solely* on nutritional status can one accept a test for utility consistency of poverty lines that is based solely on their consistency with nutritional requirements. This has lead many analysts to look for extra information. A seemingly obvious source is *subjective welfare data*. This approach recognizes explicitly that there is an inherent subjectivity to any notion of "basic needs," including nutritional requirements. Self-assessments of "welfare" are used instead to calibrate the properties of an objective welfare metric, including poverty lines. Ravallion and Lokshin (2002) use the responses of sampled Russian adults to the ladder question: "Please imagine a 9-step ladder where on the bottom, the first step, stand the poorest people, and on the highest step, the ninth, stand the rich. On which step are you today?" (Note that this specifically relates to "economic welfare" rather than the more nebulous concepts of "happiness" or "satisfaction with life.") The idea is not to actually use answers to such a question as the welfare indicator, for the answers are sure to be influenced by idiosyncratic personality factors that one would not want to base welfare assessments on.[9] Rather, econometric methods are used to extract systematic patterns in the correlations between self-rated welfare and objective circumstances that can help validate objective welfare metrics. We discuss an example later in testing Russia's poverty lines.

[8]Ravallion (1994, 1998) reviews the methods found in practice.

[9]Ravallion and Lokshin (2001) discuss this problem further and provide an econometric method of modeling subjective welfare data that is robust to individual personality traits.

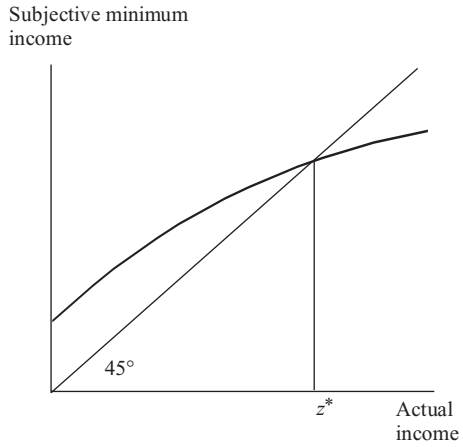

Figure 2. Subjective Poverty Line

A closely related approach bases "subjective poverty lines" on answers to the "minimum income question" (MIQ), such as the following (paraphrased from Kapteyn *et al.*, 1988): "What income level do you personally consider to be absolutely minimal? That is to say that with less you could not make ends meet." One might define as poor everyone whose actual income is less than the amount they give as an answer to this question. However, here too an allowance must be made for heterogeneity, such that people at the same standard of living may well give different answers to the MIQ. Past empirical work has found that the expected value of the answer to the MIQ conditional on actual income tends to be an increasing function of actual income.[10] Furthermore past studies have tended to find a relationship such as that depicted in Figure 2, which gives a stylized representation of the regression function on income for answers to the MIQ. The point z^* in the figure is an obvious candidate for a poverty line; people with income above z^* tend to feel that their income is adequate, while those below z^* tend to feel that it is not. In keeping with the literature, we term z^* the "subjective poverty line" (SPL).[11] It is recognized in the literature that there are other determinants of economic welfare which should shift the SPL, such as family size and demographic composition. Indeed, the answers to the MIQ are sometimes interpreted as points on the consumer's expenditure function (giving the minimum expenditure needed to assure a given level of utility) at a point of "minimum utility," interpreted as the poverty line in utility space.[12]

While the MIQ has been applied in a number of developed countries, there have been few attempts to apply it in a developing country. There are a number of potential pitfalls. "Income" is not a well-defined concept in most developing countries, particularly (but not only) in rural areas. It is not at all clear whether or

[10]Contributions include Groedhart *et al.* (1977), Danziger *et al.* (1985) and Kapteyn *et al.* (1988).

[11]The term "social subjective poverty line" might be preferable, to distinguish it from the individual subjective poverty lines. However, the meaning will be clear from the context.

[12]On the use of subjective welfare to identify cost and utility functions, see Kapteyn (1994).

not one could get sensible answers to the MIQ.[13] The qualitative idea of the "adequacy" of consumption is a more promising one in a developing country setting, and (arguably) many developed counties. Pradhan and Ravallion (2000) propose a method for estimating the SPL based on qualitative data on consumption adequacy. The method assumes that each individual has his or her own reasonably well-defined consumption norms at the time of being surveyed. At the prevailing incomes and prices, there can be no presumption that these needs will be met at the consumer's utility maximizing consumption vector. The Pradhan–Ravallion method identifies a SPL by finding econometrically the minimum expenditure on each category of goods needed to assure consumption adequacy in expectation, and then adding up these components to obtain the poverty line. Empirical examples can be found in Pradhan and Ravallion (2000) and Lokshin *et al*. (2006).

5. Russia's Poverty Lines

Russia's official poverty lines were established under guidelines developed by the Ministry of Labor and Social Development (MLSD, 2000). The precise quantities of the goods and services that enter the region-specific poverty baskets are determined by local governments following the guidelines of an inter-ministry expert group, which also reviews the draft consumer baskets submitted by the local governments and provides recommendations to the Federal Government, which makes the final decision on the composition of the regional baskets.[14] The expert group evaluates the nutritional composition of every regional basket as well as the composition of the non-food components (VTsUZH, 2002).

Russia's poverty lines explicitly incorporate specific sources of heterogeneity in needs. One source is the demographic composition of the household. Food baskets are defined based on nutritional requirements for calories, proteins, fats, and carbohydrates for five groups of individuals: children aged 0 to 6, children 7 to 15, adult males 16 to 59, adult females 16 to 54, and retired people (males 60 years of age and older and females 55 and older). The baskets also vary across the 16 geographical zones of Russia, as shown in Figure 3a, to account for differences in caloric requirements by climatic zones and for regional differences in food consumption patterns. The caloric requirements for adult males, for example, range from 3,030 kcal per day for the northern regions of Russia (food zones 1, 2, and 3) to 2,638 kcal per day for the warmer zones. Norms for the consumption of proteins

[13]One concern about the MIQ approach is that respondents may not know their actual income, or may have a different concept of "income." In all past applications of this method that we know of, the "actual income" variable used as a regressor in explaining responses to the MIQ is calculated separately from the survey questions on income sources, often including imputed values for income-in-kind. Yet survey respondents may well have some other measure of their income in mind (calculated differently, or for some other time period). This will bias estimates of the regression for minimum income and hence the subjective poverty line. A possible solution is to ask "actual income" directly and use this as the regressor—not because it is a better measure of income (which should still be measured properly), but rather because it eliminates the bias in estimating subjective poverty lines. However, we have not seen this approach implemented.

[14]The results of the latest 2001 review of the regional baskets indicate that of 89 submitted proposals, 67 drafts attracted no criticism, while the remaining 22 drafts deviated in one way or another from the methodological recommendation.

Figure 3a. Zones for Food Baskets

Figure 3b. Zones for Non-Food Goods

Figure 3c. Zones for Services

and carbohydrates can also vary substantially across zones. The final food poverty bundles comprise 34 items, which differ between zones. For example, northern zones include deer meat while the southern zones include larger shares of (relatively cheaper) fruits and vegetables. Food bundles for the zones with a predominantly Muslim population do not include pork.

While the food bundles are anchored to nutritional requirements, it is clear that Russia's poverty lines reflect a much broader concept of welfare than nutritional intakes alone. This is evident in the allowances for non-food goods. Three zones for non-food goods and three zones for services/utility baskets (Figures 3b and 3c respectively) are defined according to climatic conditions in Russia. The basket for non-food goods provides detailed quantities for six groups. These groups are similar to those used in the construction of the food basket, except that separate baskets for non-food goods are defined for elderly men and women. The service basket consists of consumption norms for seven main utilities. While the food and non-food baskets are defined at the individual level, the service baskets are defined on a per capita basis.

The non-food bundles consist of a number of personal items and some consumer durables. The non-food goods include specific items of clothing, footwear, pens and notebooks. Goods for the household's collective use are also included, comprising furniture (table, chair, chest of drawers, mirror, etc), appliances (TV, refrigerator, clocks, etc), kitchen items (plates, pots and pans, silverware), as well as towels, sheets, blankets, and pillows. Every item in the non-food bundle has an approximate usage time that varies for different age-gender groups. For example, adult males aged 18 to 59 are supposed to use one coat for seven years, while the norm for male pensioners is ten years. A blanket has a life-time of 20 years. Every prime age woman is entitled to five underwear with amortization period of 2.4 years and two bras every three years.

Russia's poverty lines incorporate only a modest allowance for scale economies in consumption, though the goods for "collective use" identified above, which only apply to certain non-food goods (and do not include housing). As we will see, this is a potentially important source of inconsistencies between the poverty lines and subjective perceptions of welfare, which often reflect scale economies in consumption; we return to this point in Section 6.2.

The services bundle includes allowances for housing, heating, electricity, hot and cold water, gas and transportation.[15] The norms for heating and electricity vary by zones. In the cold climate zones the per person heat consumption is equal to 8.0 Gcal (Giga calories) per year while in the warmer zones it is only 5.4 Gcal per year per person.

Price information on the items in the poverty baskets is collected quarterly by the Russian Central Statistical Agency ("RosStat") in 203 cities and towns of Russia for 196 food and non-food items and services. The poverty lines for every geographic zone are calculated by multiplying the quantities of the items in the baskets by the corresponding prices in an appropriate city or town within the zone.

Note that RosStat does not collect prices in the rural areas of Russia and poverty lines are thus based on urban prices. This is itself a potential source of

[15]There is no allowance for health or education since by law (at least) these are free in Russia.

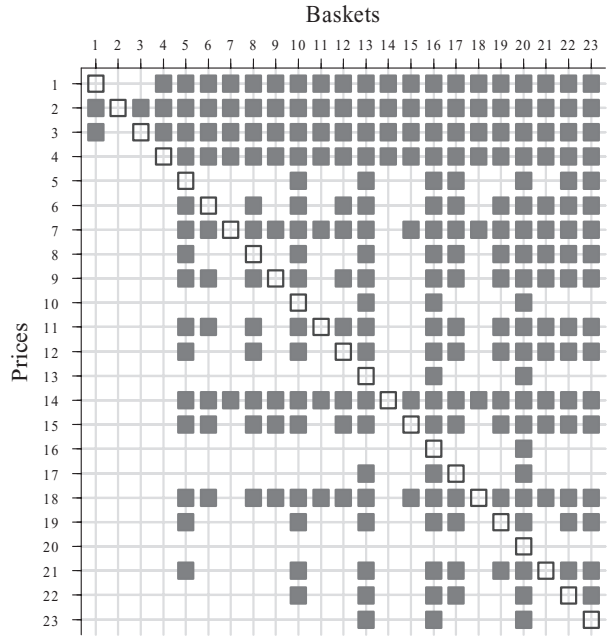

Figure 4. Results of the Revealed Preference Test for the Russian Poverty Lines

welfare inconsistencies resulting in overestimation of the poverty rates in rural areas.

In order to construct a poverty line for a particular region the cost of the food basket corresponding to this region should be added to the regional costs of the non-food goods and services. While the North-Eastern Zone I for non-food goods and Zone I for services overlap almost completely, Zones II and III cover different regions in central and southern Russia. In addition, the boundaries of the non-food goods and services zones in several cases split the food zones on two or more smaller zones. As a result, we can define 23 geographical zones that correspond to the combinations of food, non-food goods and services zones (as identified in Figure 4, which we return to below). One hundred and thirty eight distinct baskets are specified as a combination of these geographical zones and the six age-gender groups.

Table 1 shows the poverty lines in Russia in September 2002 prices (Roubles per month). Low-numbered zones in the table roughly correspond to the northern regions while high-number zones correspond to the south. The values of poverty lines tend to decline from north to south. For example, the poverty line for an adult male aged 16 to 59 is 2,534 Roubles per month for Zone 2 compared to only 1,307 Roubles per month in Zone 20. Similar tendencies can be observed for other age-gender categories.

Comparing poverty lines among different age-gender groups in Table 1 reveals that poverty lines for adult males are higher than the poverty lines for adult females and for the elderly. Surprisingly, poverty lines for children are often higher

TABLE 1

Official Poverty Lines for Russia by Geographical Zones and Age-Gender Groups

Zone	Adult Male	Adult Female	Elderly Male	Elderly Female	Children 0–6	Children 7–15
1	2,124	1,833	1,314	1,387	2,129	2,062
2	2,534	1,558	1,635	1,380	2,018	2,991
3	2,170	1,934	1,500	1,466	2,113	2,349
4	1,942	1,686	1,324	1,264	1,854	2,066
5	1,466	1,265	1,034	955	1,510	1,649
6	1,582	1,370	1,100	1,028	1,583	1,740
7	1,719	1,508	1,204	1,143	1,705	1,858
8	1,483	1,297	991	954	1,501	1,656
9	1,552	1,374	1,084	1,031	1,639	1,785
10	1,434	1,227	983	909	1,515	1,598
11	1,571	1,519	1,150	1,041	1,694	1,774
12	1,534	1,404	1,042	1,023	1,560	1,720
13	1,383	1,181	961	896	1,475	1,588
14	1,867	1,643	1,293	1,235	1,846	2,033
15	1,594	1,397	1,119	1,069	1,671	1,789
16	1,381	1,180	957	881	1,454	1,573
17	1,409	1,218	1,007	940	1,506	1,556
18	1,663	1,486	1,159	1,122	1,696	1,867
19	1,472	1,265	1,038	967	1,517	1,657
20	1,307	1,151	927	879	1,447	1,560
21	1,451	1,241	1,031	953	1,579	1,656
22	1,415	1,232	1,007	925	1,470	1,596
23	1,361	1,200	1,001	944	1,457	1,554

Note: Poverty line is calculated in 2002 Roubles per month.

than poverty lines for other categories. The reason is that the nutritional requirements for children used in Russia's poverty lines are based not only on the norms for calories, proteins, fats, and carbohydrates, but also include stipulated minimum amounts of micronutrients and vitamins. To satisfy these requirements for micronutrients the food basket for children includes more expensive items that result in higher poverty lines (Baturin, 2003).

The household poverty line is determined by summing up the individual poverty lines of the household members. For our analysis we use the poverty lines for a typical household that consists of two parents (a male aged 18 to 59 and a female aged 18 to 54) and two children (one child 0 to 6 years old and one child 7 to 15 years old). We call this the "reference household." While the bulk of the calculations presented here are for this reference, we also give summary results for other reference households.

Before we turn to our test results, it is worth reflecting on why we might expect inconsistencies in these poverty lines by revealed preference tests. Two reasons can be suggested. Firstly, as we have noted, there are differences in needs that are built into the poverty bundles. Differences in demographics and climatic differences within Russia justifiably entail that the same consumption bundle does not yield the same utility in different regions. We will see if these factors can explain any violations of revealed preference tests.

Secondly, local governments in Russia may perceive an incentive to inflate their poverty lines to attract extra resources from the center. According to the Law on Social Protection any family or single person whose average per-capita income is

below the regional poverty line is entitled to receive central government social assistance. The Federal Government allocates funds for social protection based on the number of poor in the region. Therefore, the local governments have an incentive to inflate their baskets to secure a larger share of government transfers to the region. Furthermore, this incentive may well be stronger for poorer local government areas. On balance, we cannot predict which direction the bias might go.

6. Tests of Russia's Poverty Lines

We begin with the revealed preference tests and then turn to tests across needs groups, for which purpose we draw on subjective welfare data.

6.1. *Revealed Preference Tests*

To control for heterogeneity in needs associated with demographic differences we focus on the reference household. Table 2 gives the matrix of the costs of the poverty baskets for the reference household across the 23 zones. The number in row i, column j gives the cost in zone i of the zone j poverty basket. Thus, the actual poverty lines are on the main diagonal.

The corresponding $\boldsymbol{Q}$ matrix of Laspeyres quantity indices is in Table 3. Comparing columns, it is evident that the two most generous poverty bundles are those for Zones 2 and 3, which make up Siberia. One of these dominates all other bundles, though 2 and 3 cannot be ranked unambiguously; for some price vectors, the Zone 2 bundle dominates while for others it is Zone 3. However, there can be no doubt which is the least generous bundle judged by the quantity index; the bundle for Zone 20 is unconditionally lower than that for all other bundles, i.e. $Q_{i20} < Q_{ij}$ for all $j \neq 20$. Zone 20 is the small region of Kalmukia in the southwest.

Figure 4 gives the results of our revealed preference test based on the quantity matrix in Table 3. We first do the test ignoring geographic heterogeneity in needs ($n = 1$), but relax this later. The elements of $\boldsymbol{Q}$ that are less than 1 (i.e. the test is not passing) are shaded. Overall, the test is passed for only 281 out of 529 elements of $\boldsymbol{Q}$ matrix.[16] Strikingly, of the 253 distinct pairs of bundles, mutual utility consistency is rejected for all except six pairs, namely the pairs (10,17), (10,23), (11,9), (11,15), (23,13) and (23,17). Looking at the first row, we find that utility consistency at common needs is rejected for all but two of the (i,j) combinations. Consistency is rejected for all regions when judged by region 3's needs. Rejections tend to become less common as one moves down the table. The test comes very close in region 16, with only one narrow ($Q_{16,20} = 0.984$) rejection.

Zone 20 stands out as unusual in three respects. Firstly, as we have noted, it is the bundle with the lowest quantity index for all prices. Secondly, it is the only bundle that passes out test; judged by Zone 20's needs, we cannot reject consistency across all the bundles. Thirdly, the bundle for Zone 20 accounts for more rejections than any other zone. Indeed, there is no zone for which consistency with

[16]Consistency tests for the individual $\boldsymbol{Q}$ matrixes show different numbers of passing elements (details can be found in the working paper version; see Ravallion and Lokshin, 2004). The adult male matrix has 250 passes, while the matrices for adult females, children 0–7 and children 7–15 have 251, 247 and 248 respectively.

TABLE 2

POVERTY LINES BY ZONES FOR THE REFERENCE HOUSEHOLD OF TWO PARENTS, TWO CHILDREN; SEPTEMBER 2002 ROUBLES PER MONTH

	Baskets																						
Prices	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	8,148	9,222	9,152	8,003	6,335	6,720	7,252	6,450	6,911	6,114	6,930	6,542	6,031	7,766	6,940	5,995	6,062	7,161	6,361	5,863	6,368	6,212	6,133
2	8,154	9,101	9,081	8,032	6,341	6,737	7,174	6,407	6,867	6,060	6,851	6,536	6,028	7,726	6,934	5,976	6,057	7,148	6,303	5,831	6,345	6,138	6,043
3	7,686	8,571	8,566	7,551	5,991	6,345	6,782	6,027	6,486	5,719	6,476	6,150	5,680	7,311	6,538	5,641	5,713	6,757	5,945	5,517	5,996	5,798	5,706
4	7,701	8,706	8,656	7,548	5,999	6,345	6,858	6,084	6,540	5,790	6,561	6,181	5,690	7,362	6,557	5,670	5,727	6,781	6,008	5,553	6,028	5,867	5,794
5	7,607	8,655	8,657	7,525	5,890	6,277	6,794	6,015	6,448	5,734	6,497	6,175	5,662	7,326	6,485	5,601	5,663	6,701	5,972	5,541	5,987	5,840	5,794
6	7,603	8,651	8,652	7,522	5,887	6,274	6,793	6,012	6,445	5,731	6,495	6,171	5,658	7,321	6,483	5,600	5,660	6,699	5,970	5,538	5,985	5,837	5,792
7	7,599	8,648	8,648	7,519	5,884	6,272	6,791	6,010	6,442	5,728	6,493	6,167	5,655	7,316	6,481	5,598	5,658	6,697	5,968	5,535	5,983	5,834	5,790
8	7,554	8,477	8,494	7,482	5,852	6,254	6,662	5,936	6,353	5,639	6,373	6,128	5,627	7,217	6,443	5,539	5,626	6,641	5,867	5,461	5,922	5,719	5,648
9	7,550	8,473	8,490	7,479	5,849	6,251	6,660	5,934	6,350	5,637	6,370	6,124	5,624	7,212	6,440	5,537	5,624	6,639	5,865	5,459	5,919	5,716	5,646
10	7,809	8,713	8,703	7,671	6,062	6,419	6,855	6,109	6,551	5,774	6,537	6,220	5,743	7,380	6,618	5,707	5,779	6,827	6,010	5,582	6,066	5,870	5,774
11	7,812	8,731	8,723	7,678	6,065	6,430	6,867	6,116	6,572	5,789	6,557	6,237	5,754	7,403	6,630	5,717	5,791	6,845	6,027	5,594	6,079	5,879	5,783
12	7,790	8,689	8,680	7,651	6,057	6,413	6,847	6,100	6,556	5,776	6,530	6,219	5,732	7,367	6,610	5,702	5,772	6,826	6,004	5,575	6,055	5,855	5,761
13	7,572	8,470	8,491	7,500	5,871	6,264	6,667	5,947	6,363	5,642	6,364	6,127	5,627	7,201	6,450	5,550	5,632	6,649	5,868	5,461	5,919	5,719	5,638
14	7,823	8,749	8,718	7,675	6,081	6,435	6,873	6,142	6,581	5,813	6,569	6,254	5,753	7,389	6,641	5,725	5,798	6,847	6,037	5,591	6,084	5,882	5,790
15	7,564	8,598	8,595	7,481	5,858	6,246	6,756	5,980	6,412	5,705	6,462	6,142	5,629	7,284	6,450	5,571	5,631	6,665	5,934	5,507	5,952	5,802	5,755
16	7,593	8,590	8,603	7,521	5,878	6,274	6,741	5,984	6,429	5,697	6,452	6,146	5,648	7,287	6,473	5,588	5,654	6,686	5,940	5,499	5,957	5,792	5,713
17	7,646	8,590	8,619	7,559	5,916	6,311	6,760	6,013	6,434	5,704	6,453	6,186	5,680	7,285	6,515	5,604	5,688	6,714	5,948	5,531	5,992	5,808	5,740
18	7,641	8,586	8,614	7,556	5,914	6,309	6,759	6,010	6,431	5,701	6,451	6,182	5,676	7,281	6,512	5,602	5,685	6,712	5,946	5,528	5,990	5,805	5,738
19	7,602	8,546	8,555	7,529	5,887	6,280	6,704	5,982	6,402	5,684	6,406	6,156	5,643	7,238	6,474	5,577	5,653	6,680	5,911	5,492	5,948	5,748	5,681
20	7,611	8,499	8,521	7,535	5,895	6,279	6,681	5,980	6,369	5,668	6,385	6,146	5,636	7,210	6,464	5,566	5,640	6,651	5,884	5,464	5,930	5,734	5,657
21	7,607	8,495	8,517	7,532	5,892	6,276	6,679	5,978	6,366	5,665	6,383	6,142	5,633	7,205	6,461	5,564	5,638	6,649	5,882	5,461	5,928	5,731	5,655
22	7,517	8,439	8,437	7,471	5,852	6,228	6,629	5,929	6,322	5,633	6,345	6,134	5,608	7,167	6,412	5,524	5,609	6,607	5,849	5,456	5,887	5,713	5,640
23	7,437	8,359	8,360	7,411	5,800	6,190	6,585	5,862	6,301	5,593	6,297	6,087	5,571	7,145	6,366	5,492	5,576	6,585	5,813	5,426	5,846	5,665	5,571

TABLE 3

Matrix of Laspeyres Quantity Indices for the Reference Household

		Baskets																						
Prices	No. Zones Test Fails	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	20	1.000	1.132	1.123	0.982	0.778	0.825	0.890	0.792	0.848	0.750	0.851	0.803	0.740	0.953	0.852	0.736	0.744	0.879	0.781	0.720	0.782	0.762	0.753
2	22	0.896	1.000	0.998	0.883	0.697	0.740	0.788	0.704	0.755	0.666	0.753	0.718	0.662	0.849	0.762	0.657	0.666	0.785	0.693	0.641	0.697	0.674	0.664
3	21	0.897	1.001	1.000	0.881	0.699	0.741	0.792	0.704	0.757	0.668	0.756	0.718	0.663	0.853	0.763	0.659	0.667	0.789	0.694	0.644	0.700	0.677	0.666
4	19	1.020	1.153	1.147	1.000	0.795	0.841	0.909	0.806	0.866	0.767	0.869	0.819	0.754	0.975	0.869	0.751	0.759	0.898	0.796	0.736	0.799	0.777	0.768
5	7	1.292	1.470	1.470	1.278	1.000	1.066	1.154	1.021	1.095	0.974	1.103	1.048	0.961	1.244	1.101	0.951	0.961	1.138	1.014	0.941	1.017	0.992	0.984
6	12	1.212	1.379	1.379	1.199	0.938	1.000	1.083	0.958	1.027	0.913	1.035	0.984	0.902	1.167	1.033	0.892	0.902	1.068	0.951	0.883	0.954	0.930	0.923
7	17	1.119	1.273	1.273	1.107	0.866	0.924	1.000	0.885	0.949	0.843	0.956	0.908	0.833	1.077	0.954	0.824	0.833	0.986	0.879	0.815	0.881	0.859	0.853
8	10	1.273	1.428	1.431	1.260	0.986	1.054	1.122	1.000	1.070	0.950	1.074	1.032	0.948	1.216	1.085	0.933	0.948	1.119	0.988	0.920	0.998	0.963	0.952
9	13	1.189	1.334	1.337	1.178	0.921	0.984	1.049	0.934	1.000	0.888	1.003	0.964	0.886	1.136	1.014	0.872	0.886	1.045	0.924	0.860	0.932	0.900	0.889
10	3	1.352	1.509	1.507	1.329	1.050	1.112	1.187	1.058	1.135	1.000	1.132	1.077	0.995	1.278	1.146	0.988	1.001	1.183	1.041	0.967	1.051	1.017	1.000
11	13	1.191	1.332	1.330	1.171	0.925	0.981	1.047	0.933	1.002	0.883	1.000	0.951	0.878	1.129	1.011	0.872	0.883	1.044	0.919	0.853	0.927	0.897	0.882
12	11	1.253	1.397	1.396	1.230	0.974	1.031	1.101	0.981	1.054	0.929	1.050	1.000	0.922	1.185	1.063	0.917	0.928	1.098	0.965	0.896	0.974	0.941	0.926
13	2	1.346	1.505	1.509	1.333	1.043	1.113	1.185	1.057	1.131	1.003	1.131	1.089	1.000	1.280	1.146	0.986	1.001	1.182	1.043	0.971	1.052	1.016	1.002
14	18	1.059	1.184	1.180	1.039	0.823	0.871	0.930	0.831	0.891	0.787	0.889	0.846	0.779	1.000	0.899	0.775	0.785	0.927	0.817	0.757	0.823	0.796	0.784
15	14	1.173	1.333	1.333	1.160	0.908	0.968	1.047	0.927	0.994	0.884	1.002	0.952	0.873	1.129	1.000	0.864	0.873	1.033	0.920	0.854	0.923	0.900	0.892
16	1	1.359	1.537	1.539	1.346	1.052	1.123	1.206	1.071	1.150	1.019	1.154	1.100	1.011	1.304	1.158	1.000	1.012	1.196	1.063	0.984	1.066	1.036	1.022
17	3	1.344	1.510	1.515	1.329	1.040	1.110	1.189	1.057	1.131	1.003	1.135	1.088	0.999	1.281	1.145	0.985	1.000	1.180	1.046	0.972	1.053	1.021	1.009
18	16	1.139	1.279	1.283	1.126	0.881	0.940	1.007	0.895	0.958	0.849	0.961	0.921	0.846	1.085	0.970	0.835	0.847	1.000	0.886	0.824	0.892	0.865	0.855
19	8	1.286	1.446	1.447	1.274	0.996	1.062	1.134	1.012	1.083	0.962	1.084	1.042	0.955	1.224	1.095	0.944	0.956	1.130	1.000	0.929	1.006	0.972	0.961
20	0	1.393	1.555	1.559	1.379	1.079	1.149	1.223	1.094	1.166	1.037	1.168	1.125	1.031	1.319	1.183	1.019	1.032	1.217	1.077	1.000	1.085	1.049	1.035
21	9	1.283	1.433	1.437	1.271	0.994	1.059	1.127	1.008	1.074	0.956	1.077	1.036	0.950	1.216	1.090	0.939	0.951	1.122	0.992	0.921	1.000	0.967	0.954
22	6	1.316	1.477	1.477	1.308	1.024	1.090	1.160	1.038	1.107	0.986	1.111	1.074	0.982	1.254	1.122	0.967	0.982	1.157	1.024	0.955	1.030	1.000	0.987
23	2	1.335	1.500	1.501	1.330	1.041	1.111	1.182	1.052	1.131	1.004	1.130	1.093	1.000	1.282	1.143	0.986	1.001	1.182	1.043	0.974	1.049	1.017	1.000
$\bar{Q}_j$		1.205	1.355	1.355	1.191	0.935	0.995	1.066	0.949	1.016	0.901	1.018	0.973	0.894	1.149	1.026	0.885	0.896	1.059	0.937	0.870	0.943	0.914	0.903

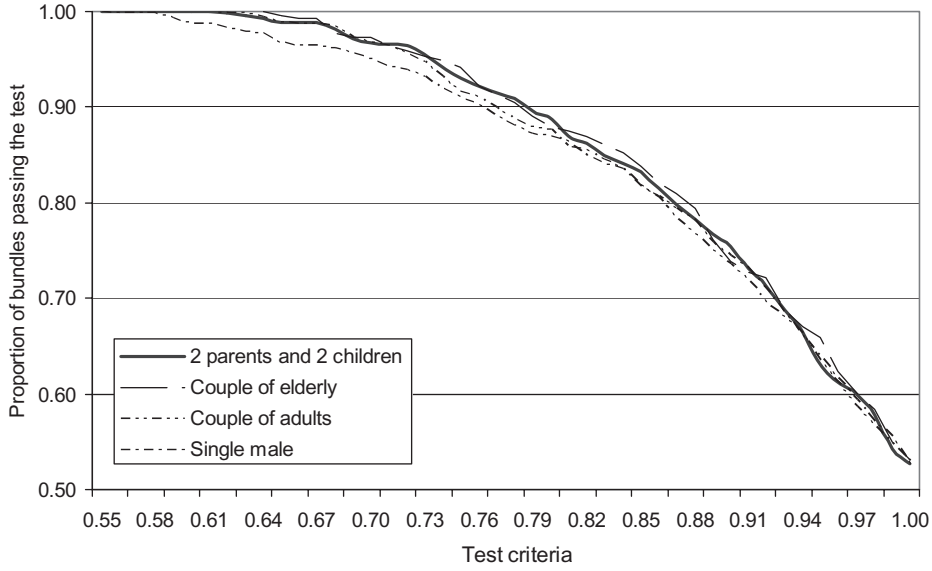

Figure 5. Proportion of Bundles Passing the Revealed Preference Test for Different Test Criteria

Zone 20 passes. Clearly these three observations are related. The low value of the Zone 20 bundle makes it more likely to be utility consistent, and more likely to differ from the bundles elsewhere.

One might argue that some relaxation of our test criterion is warranted to account for errors. There is no way of calculating standard errors for the $\boldsymbol{Q}$ matrix since there is no explicit sampling or parameter estimation involved. The best we can do is simply to test sensitivity to relaxing the test criterion. Figure 5 shows how the share of poverty lines passing the test varies with the test criterion. For example, if we relax the test conditions to allow values of $Q_{ij} > 0.950$ to pass then the number of elements that satisfy the consistency test would increase by almost 20 percent to 350 cells. It is clear that even under far less stringent conditions, a large share of the Russia regional poverty lines do not pass our test.

Figure 5 also gives results for other reference households, namely a couple of elderly, a couple of adults and a single male. The choice of reference household does not much affect the conclusions on the extent of the failures of our revealed preference test.

Is it possible to find scalar transformations of the poverty bundles that would satisfy our revealed preference test? Recall that a necessary condition for the existence of such a vector is that all the products of mirror-opposite elements of $\boldsymbol{Q}$ matrix are not less than unity. Analyzing the numbers shown in Table 3 we find that the product of opposite elements is less than unity for 57 out of 144 pairs in the $\boldsymbol{Q}$ matrix. This rejects the possibility of finding a set of scalar corrections to the original bundles that will assure that our consistency test passes. The internal composition of the bundles would need to change.

Given that there are geographic differences in consumption needs these violations of the revealed preference criteria do not on their own imply utility

Figure 6. Mean Quantity Index by Zone

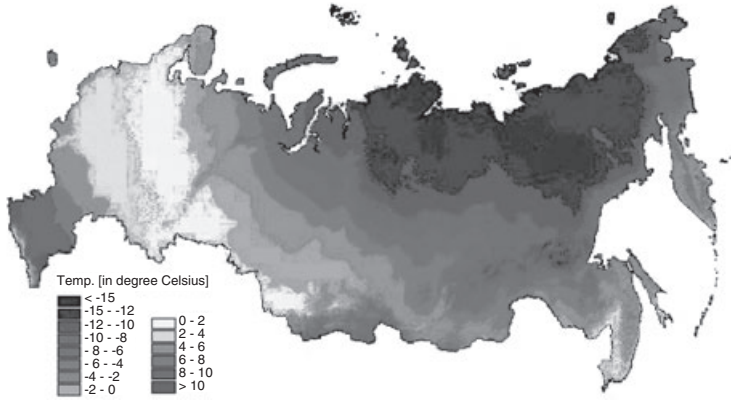

Figure 7. Mean Annual Temperature in Russia

Source: Potsdam Institute for Climate Impact Research and Land Use Change Project, IIASA (International Institute for Applied Systems Analysis), Austria (www.iiasa.ac.at/).

inconsistencies. Figure 6 maps the mean quantity indices ($\bar{Q}_j$). There is a marked north-south difference, which is clearly correlated (negatively) with temperature; Figure 7 maps mean temperatures.[17] The cooler the climate, the more generous the bundle as measured by the mean quality index. This suggests that the differences

[17]Given that the temperature map is at a much finer level, calculating a correlation coefficient would require considerable aggregation. From eye-balling the figures, the extent of the correlation is clearly high, however.

TABLE 4

REVEALED PREFERENCE TESTS FOR CLUSTERS OF ZONES WITHIN COMMON TEMPERATURE BANDS

Cluster 1: 8–10° Celsius zone

	Zones	
	20	22
20	1.000	1.049
22	0.955	1.000

Cluster 2: 2–4° Celsius zone

	Zones			
	5	15	16	18
5	1.000	1.101	0.951	1.138
15	0.908	1.000	0.864	1.033
16	1.052	1.158	1.000	1.196
18	0.881	0.970	0.835	1.000

Cluster 3: 0–2° Celsius zone

	Zones			
	7	8	9	13
7	1.000	0.885	0.949	0.833
8	1.122	1.000	1.070	0.948
9	1.049	0.934	1.000	0.886
13	1.185	1.057	1.131	1.000

Cluster 4: –4 to –2° Celsius zone

	Zones		
	10	11	14
10	1.000	1.132	1.278
11	0.883	1.000	1.129
14	0.787	0.889	1.000

in the consumption bundles may well reflect differences in the commodities needed to reach the same utility level in different climates.

However, climate differences cannot account fully for the violations of our revealed preference tests. By superimposing the temperature map (Figure 7) on the zones for which distinct poverty lines are identified (Figure 6) we can identify four distinct clusters of zones within a close range of temperatures, as identified in Table 4, which also give results of our revealed preference tests *within* each of these clusters. Again, rejections are indicated for about half the cases.[18] Mutual consistency is rejected for every pair within each temperature band.

6.2. *Testing Consistency Across Needs Groups*

In testing the utility consistency of the Russian poverty lines across different needs groups we draw on our previous research using self-rated welfare data

[18]It is also readily verified from Table 4 that our necessary conditions for existence of a set of scalar corrections that will assure that our test passes are satisfied for clusters 1 and 4, while these conditions are rejected (though narrowly) for clusters 2 and 3.

(Ravallion and Lokshin, 2002); here we only summarize the salient results for the present discussion.

Answers to the welfare ladder question given in Section 4 are used to test whether self-rated welfare responds the same ways to a set of needs covariates as does income normalized by the official poverty lines. Recall that the ladder question relates to what can be termed "economic welfare," in that it explicitly refers to a scale from "poor" to "rich." The ladder question is ordinal, but we assume that the answers are generated by a latent continuous utility indicator, u:

$$u = \beta \log[y/g(x)] + \gamma x + \varepsilon \tag{6}$$

where y is household income and x is a vector of household and individual attributes (including geographic dummy variables) deemed relevant to needs and $g(x)$ is the poverty line corresponding to x. We then use an ordered probit to retrieve estimates of these parameters β and γ consistent with the ordinal responses to the ladder question. Notice that equation (6) allows the subjective valuation of x to differ from the objective one, as incorporated in the function g; if the variables in x have been incorrectly weighted in the function g then we will find that $\gamma \neq 0$. The data are from the Russian Longitudinal Monitoring Survey.

A number of differences in the properties of the poverty lines and the self-rated welfare data are evident from the test results reported in detail in Ravallion and Lokshin (2002, Table 2). The poverty lines have an overall elasticity of 0.8 to household size, while the implicit deflator in the subjective indicator calls for an elasticity half this size.[19] The demographic composition variables also behave very differently. Most notably, due to the properties of the poverty lines, an objective welfare metric based on income deflated by the poverty line deems pensioner households to be less poor than others *ceteris paribus*, while the subjective welfare indicator indicated the opposite. A weak correspondence in the geographic effects is also notable; while there are a number of strong geographic effects in perceptions of economic welfare, they bear very little relationship to the cost-of-living differences built into the poverty lines (Ravallion and Lokshin, 2002).

7. Conclusions

We have brought together ideas from two literatures—one on the theory of revealed preference and one on subjective well-being—to propose operational tests of the internal consistency of a set of poverty lines. The theory of revealed preference offers readily testable necessary conditions for the utility consistency of poverty lines across sub-groups of a population assuming common consumption needs. However, assuming common needs is restrictive when setting poverty lines. There are plausible reasons why the same poverty bundle can yield different utilities in different settings, such as differences in socially determined consumption needs or differences in climatic conditions. Testing poverty lines between groups with different needs cannot be based solely on knowledge of the quantities

[19]The elasticity of the poverty line to household size was estimated by fixing the latent utility index and solving the estimated econometric model for the poverty line as a function of the control variables, including household size; see Ravallion and Lokshin (2002) for further details.

and prices but will require extra information for forming judgments about the welfare relevance of differences in consumption needs. That extra information has typically been sought in nutritional requirements, though this requires the unacceptably restrictive assumption that utility depends solely on nutritional status. A more promising approach draws on subjective welfare data. The utility consistency of poverty lines across different needs groups is then tested by comparison with the deterministic component of individuals' self assessments of their economic welfare. A variation on this approach identifies the poverty line as the consumption or income level below which people tend to think they are "poor" and above which they do not.

As a case study, we have studied the official poverty lines for Russia. These specify a long list of goods and services in region-specific and demographically specific bundles, guided by an expert group set up by the central government, though with a degree of decentralized local power over the final poverty lines. We find that we can generally reject utility consistency for common needs. Nor does there exist a set of scalar corrections that would assure that our tests pass; satisfying revealed preference criteria would require internal corrections to the original poverty bundles.

On their own, these results would be unsurprising given that there must be a strong *a priori* presumption that consumption needs vary across groups. However, we do not find that the violations of the implications of utility consistency are explicable in terms of the sources of heterogeneity in needs identified in the documentation of the official lines. Nor do the differences in poverty lines between different "needs groups" correspond well with self-rated perceptions of welfare.

Taken as a whole, our results suggest that Russia's poverty lines are not utility consistent. People living at the poverty line in different demographic or geographic groups arguably do not have the same level of welfare. The inconsistencies that we find could well stem from the decentralized administrative process generating the poverty bundles.

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