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SPATIAL DIFFERENCES IN POVERTY

The Case of Peru

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This paper examines the implications of spatial differences in living costs for measures of poverty. Taking Peru as a case study, spatial price indices are used to calculate location-specific poverty lines, based on the local cost of a basket of basic needs. Applied to income distribution data, these poverty lines yield measures of the extent and location of poverty. The paper shows that these measures are significantly different from, and much more accurate than those obtained using a single countrywide poverty line; the latter can give a misleading picture of poverty by overstating spatial differences, in general overestimating rural and underestimating urban poverty.

1. Introduction

It is generally accepted that living costs vary between different places within countries and that a given income may have different real values in different places. Despite this recognition, it is common in the administration of economic policy to use the same money income level as a reference point across a whole country (e.g., to assess income tax liabilities or eligibility for welfare payments, and determine the size of publicly administered old age pensions), for while it may be possible to vary income thresholds depending on local costs of living, and would be more equitable on an interpersonal basis, doing so would clearly create administrative complications.

Spatial differences in the costs of living, however, have serious implications for the design of policies and programs to alleviate poverty. For example, in measuring the extent of the poverty problem, a single money income poverty line applied across a whole country, may in fact represent widely different levels of purchasing power. Some of those designated as poor (being below the poverty line) in an area where living costs are low, will in real terms be

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better off than some, living in a high cost area, who are excluded from the target group because their incomes fall above the poverty line. Thus, the measure will tend to overestimate the numbers of poor in low cost areas, and vice versa. And, as a result, it will give a misleading impression of the location and extent of poverty. Exactly how misleading, will not normally be intuitively obvious.

To throw light on this question, this paper takes the case of Peru and describes the use of spatial differences in the costs of basic requirements in the measurement of poverty. First, an empirical discussion is presented of the spatial differences in the prices of the 'basic' food and non-food items in Peru. Section 2 of the paper uses the estimates made by Thomas (1978) of the price variation of these two categories, in deriving overall consumer price indices for the different locations. In section 3, these prices indices are applied to a money income level that corresponds to what may be considered as an 'absolute' poverty level. This enables us to derive poverty lines that are specific to the different parts of the country. In section 4 these poverty lines are applied to actual income and its distribution in the different parts of the country to estimate various indices of poverty. The results thus derived are compared with those obtained by using a single national poverty line, to show how misleading the latter can be.

The analysis draws on a 1971–72 country-wide household survey undertaken by the Ministry of Agriculture. The results of this survey called ENCA were published after 1975.[1] The ENCA classification of the economy into three distinct regions – Coast, Sierra and Selva – appears to be an excellent basis for examining Peru's regional differences. We shall further distinguish three areas of the country differing sharply in their degree of urbanization – Lima, the largest urban center, Urban Coast, representing all the cities of the Coast, and Rural Sierra, representing all locations with less than 2000 people in Sierra.

2. Spatial price indices

To obtain location-specific poverty lines that reflect comparable levels of consumer expenditure, regional consumer price indices are required. Ideally, consumer price indices should allow us to compare the regional differences in the cost of achieving a certain level of utility. If people and locations were identical, a given basket of goods and services could be assumed to provide the same level of utility. Realistically, however, people's needs and tastes, as well as the quality of goods and services, vary from place to place and it is

[1]The data given in this paper were obtained from the ENCA tapes by kind courtesy of the Ministry of Economics and Finance and are given in the World Bank Working Paper (273). The basic information has now been published by the Ministry of Agriculture and the Ministry of Economics and Finance, Lima, Peru.

thus difficult to define baskets of goods and services that are appropriate across a whole country, or to argue that such baskets provide the same level of utility.

Some of these problems may not arise in the case of food, since the level of nutrition can be defined in terms of calories and proteins. One can calculate a food price index that reflects differences in the cost of achieving a certain level of nutrition 'required' for each location. Of course, a variety of food baskets, differing in their compositions and hence prices, can provide the 'required' level of nutrition. Ideally, perhaps, a basket should be chosen for each location that reflects the availability of food items and the revealed preference of the people in that location. And since the price index being calculated is that of achieving the 'minimum' requirements, the preferences or tastes of the poor should be focussed upon.

In the actual estimations presented in this paper, a single basket of food items is used for all regions, assuming that these items are widely available throughout the country. This basket consists of the items consumed by the Rural Sierra's people at the twentieth percentile of the income range; the overall quantity of food in the basket, however, is adjusted to meet the nutritional requirements for each location as recommended by Peru's National Planning Institute (1975). A different food basket for the twentieth percentile in each region was not used, because data were available only for Lima, Urban Coast and Rural Sierra. Since Rural Sierra is the poorest of these three locations, its data at the twentieth percentile were used to give the composition of a poor person's diet. To the extent that this particular basket used is not widely available and or the items in it are not revealed preferred by the poor uniformly across locations, the cost differences derived on its basis in this paper will be exaggerated.

Measuring and pricing the consumption of services and commodities other than food raises problems that will be met in most attempts to compare levels of living within countries. Data on non-food expenditures are frequently available from household budget surveys for a number of locations, but the quantities consumed may not be reported, or the commodity specifications may be poor, or not consistent with the available price data. Even if some quantity estimates are available, 'minimum requirements' of non-food items are hard to define and measure, and as a result, regional variation in needs is difficult to assess. Quality differences of non-food items are similarly hard to account for. If price data are available for at least some of the main non-food categories like housing, clothing and transportation, one may attempt to define 'comparable' quantity units and build a non-food price index directly on this basis. Peruvian data on non-food prices do not permit this.

In the face of these difficulties Thomas (1978) suggests a method of calculating a non-food price index for Peru from data on non-food

expenditure. In that approach it is assumed that regional expenditure data at the mean refer to equivalent baskets of goods and services. In reality, however, considerable quality differences exist; because of this, it would have been better, had the data permitted, to construct the price indices on the basis of expenditure data for groups at similar positions in the income distribution. The approach, however, is to think of mean differences in expenditures in any location relative to the country average as the product of a price difference and as quantity difference. The quantity difference is then explained in terms of a price difference and an income difference between locations. Writing them in their price and income elasticity forms and using the relations given by the Slutsky equations [see McCloskey (forthcoming)], the price in any location is expressed as an index with average price in the country as the base. In particular, the approach uses the relationships between food and non-food elasticities for a two-good world, which permit the use of food elasticities to approximate the required non-food elasticities.

The price indices as presented in this paper are those calculated by Thomas (1978) using the following steps. The prices of food categories in the food basket is taken from the ENCA survey and converted into relative prices, with national average prices taken as 100 for each commodity. The relative prices of the various food commodities in the basket are weighted according to the importance of the commodities in the national average budget, to give a price index of food items. For simplicity, the national average expenditure weights are assumed for all regions; the final results do not appear to be very sensitive to the use of regional expenditure weights, instead. A non-food price index, is calculated based on data on national non-food expenditure. The non-food expenditure differences of each location from Peru's national average expenditure are converted into non-food price differences using estimated values of income and price elasticities of food demand for the nation of respectively 0.7 and −0.4. The results are not very sensitive to alternative values of these elasticities. Using the weights of food and non-food categories in budget of the national average family of 0.5 each, the two price indices, for food and non-food, are combined into an overall price index for each region. The use of national expenditure weights as opposed to regional weights simplifies the procedure tremendously while not affecting the results significantly.

The use of a national average income elasticity indicates the quantities that would be consumed in a hypothetical 'average' location at different income levels. It will not fully identify differences in the quantity consumed in a particular place that arise due to location-specific needs. The procedure used in this paper for instance, will not identify that part of urban people's higher consumption that takes place purely due to the fact that they are city-dwellers – for example, larger consumption of transportation, clothes safety devices. Such quantity differences, beyond those in the 'average' location, will

instead become part of the price differences. This feature of our method is reasonable insofar as this type of quantity differences does not enhance welfare (e.g., the urban dwellers are not better off because of their larger consumption of safety devices); if on the contrary, it does contribute to welfare, the price index as calculated in this paper for the urban areas will be biased upwards.

Table 1

Interregional price indices Peru (1971).[a]

	Peru	Lima	Coast	Sierra	Selva	Urban Coast	Rural Sierra
1. Food	100	125	106	87	97	100	84
2. Non-Food	100	157	102	72	97	125	56
3. Overall	100	141	103	79	97	118	70
4. Based on minimum wage	100	140	106	79	99	104	72

[a]*Source:* Thomas (1978)

Table 1 presents the estimated price variation between the major regions and the three chosen areas. The food price index as given in row 1 reflects the cost differences of 'the typical diet' of the poor. The actual cost of this diet varies between 3,943 soles per capita per year in Lima; 3,470 soles in Urban Coast; and 2,650 soles in Rural Sierra. Among the three regions, the Coast shows the highest cost for this food basket 3,344 soles per capita per year, compared to 2,745 soles in Sierra and 3,060 soles in the Selva. The national average cost is 3,155 soles per capita per year. Row 2 in table 1 shows the cost differences in buying the non-food requirements in the various locations. Non-food prices are highest in Lima and the Coast, followed by Selva and Sierra. They increase with the degree of urbanization: non-food prices in Lima appear to be over 25% higher than in other big cities in the Coast and about three times these in the villages of Sierra. The overall price index shown in row 3 is a weighted average of rows 1 and 2. There are considerable price differences between the Coast, Sierra and Selva, and, not surprisingly, urban areas in general seem to be more expensive to live in. In an alternative attempt to construct a price index, information on the minimum wage established by the Ministry of Labor, Peru, was used. Row 4 in table 1 shows estimates of minimum wages for the regions and areas converted into an index with a national average of 100 as base. This index shows divergences between Lima and Rural Sierra, and between Coast, Sierra and Selva, which are remarkably similar to the previous results. To the extent that minimum wage differentials accurately reflect the income levels required to achieve comparable levels of living, they strengthen the present results.

3. Poverty levels

Definitions of absolute poverty are based on an individual's (or household's) ability to afford some specified basket of goods and services. Here, we define the absolute poverty basket on criteria similar to those adopted by the World Bank in 1976 for the estimation of income cut-off points for project identification purposes. The method used was based on Orshansky's approach which, although rather crude, is still used as the basis for estimating poverty income levels in the U.S. According to Orshansky (1965, 1969) the poverty income level is determined by costing a hypothetical adequate diet and adjusting this cost to allow for non-food consumption, according to the proportions of food and non-food expenditures in the budget of the average family. The average U.S. family spends a third of its income on food. The poverty line is therefore taken as three times the cost of the hypothetically adequate diet. This multiplier is clearly inappropriate where the percentage of food expenditure in average household budgets varies widely but is usually far above one-third. The work on Bank member countries thus combined elements of both absolute and relative definitions of poverty: (i) the cost of the food component of the poverty level income was calculated on the basis of the food expenditures of the twentieth percentile in the income distribution of the country in question, adjusted upwards if necessary to ensure nutritional adequacy, (ii) the multiplier used to arrive at the poverty level income was the ratio of non-food expenditure of the twentieth percentile.

In constructing the absolute poverty expenditure levels for the different parts of Peru, the food element is based on the cost of a basket consumed by people at the twentieth percentile in the income distribution in Rural Sierra, which was the basis for the food price index. This cost, of 2,650 soles per capita-year, provides a lower bound on food costs. This basket satisfies the nutritional requirements of those who consume it in Rural Sierra, and its contents need only small adjustments to meet the nutritional requirements typical in other parts of the country. The costs of the basket in other regions, derived by applying the food price indices (table 1, row 1) are given in row 1 of table 2.

As regards the non-food component of living costs, it would not be appropriate simply to use the national average ratio of food/non-food expenditures as is done in the U.S.: nationally, average per capita non-food expenditure in Peru is just 1% greater than food expenditure, but the average ratio of non-food to food expenditure varies from 0.5:1 in Rural Sierra to 1.93:1 in Lima. (At the twentieth percentile in Lima, food and non-food expenditures are about equal, like the average for Peru as a whole.) For the population of Rural Sierra as a whole, and at the twentieth percentile in Urban Coast, expenditures on non-food are only half those on food. This

may be typical of large parts of the country. For the present study, the low ratio of non-food expenditures of 0.3:1 is adopted as a minimum figure: this is the non-food/food ratio at the fiftieth percentile in Rural Sierra. Estimates made on this basis are referred to as 'low' in the tables that follow. Estimates were also made using a ratio of 0.5:1; these are referred to as 'medium'.

Table 2

Poverty expenditure levels Peru (1971) (soles per capita-year)

	Regions					Areas	
	Peru	Lima	Coast	Sierra	Selva	Urban Coast	Rural Sierra
1. Food cost	3155	3943	3344	2745	3060	3470	2650
2. Non-food cost							
(a) low ($NFF=0.3$)	1420	2229	1448	1022	1377	1775	795
(b) medium ($NFF=0.5$)	2366	3715	2413	1704	2295	2958	1325
3. Absolute poverty expenditure							
(a) low ($NFF=0.3$)	4575	6172	4792	3767	4437	5245	3445
(b) medium ($NFF=0.5$)	5521	7658	5757	4449	5355	6428	3975
4. Minimum wage	4167	6658	5100	3765	4753	4956	3445

The cost of non-food requirements that is implied by the 0.3:1 ratio [given by row 2(a)] is added to the minimum food costs shown in the first row of table 2. The non-food requirements for the other parts of Peru are estimated by applying the non-food price index to the estimated non-food expenditure for Rural Sierra. Row 3(a) perhaps represents a lower bound on absolute poverty expenditure levels. Row 3(b) shows the somewhat higher estimates of poverty levels made using a higher non-food cost 2(b) based on a non-food food expenditure ratio of 0.5:1. Both the poverty levels show considerable differences in expenditures across regions and areas, needed to buy, what may be considered the 'basic' requirements. The required expenditure, according the 'low' estimate in Lima, is 35% higher than the national average, while that in Rural Sierra is 25% below the national average. Row 4 of table 2 shows estimates of annual per capita minimum wages. Data on minimum wages, estimated by Peru's Ministry of Labor, were multiplied by 1.9 – the national average number of earners per family – and then divided by 6 – the national average number of earners per family – and then divided by 6 – the national average family size.

4. Poverty indices

To derive poverty indices, we need to compare the poverty expenditure

levels, given in rows 3 and 4 of Table 2, with the actual distribution of expenditure. But since data on expenditure distribution were not readily available at the time of this study, income distribution estimates given by Peru's Ministry of Economics and Finance (1977) were used instead. It was found, however, that mean income estimates were well below mean expenditures, particularly for Sierra and Selva and the rural areas. This might be due to under-reporting of income in these areas and or the inability of the sampling method used to fully capture the seasonality of income. Therefore to make the poverty expenditure levels comparable with the data on income distribution, the former were adjusted downwards, where necessary, using ratios of mean incomes to expenditures.

This section compares estimates of poverty obtained using a single poverty line with those based on the region specific poverty lines. Table 3 compares the percentage and numbers of poor below the alternative poverty thresholds. Table 3 shows only the poverty expenditure levels, as estimated in table 2 and not the adjusted poverty 'income' levels (previous paragraph) to simplify the exposition. It may be noted however, that the percentages and numbers of poor in that table were derived combining adjusted poverty income levels with the income distribution data. Tables 4 and 5, however, exclusively show the adjusted poverty 'income' levels because some of the remaining rows of these tables have direct arithmetic relationships to them.

Row 1 of table 3 shows a single poverty threshold of 4,575 soles obtained by applying a required non-food expenditure of only 0.3 of the expenditure needed to satisfy nutritional needs. Rows 2 and 3 show the 'low' and 'medium' values of the poverty expenditure thresholds after adjusting for regional cost of living differences, while row 4 shows the per capita minimum wage.

Based on the 'low' poverty threshold, 28% of Peru's population, or 3.84 million people, cannot satisfy the 'basic' requirements. About 2.28 million, or 59% of them, live in Sierra. Within the regions and areas, the proportions of population who are below the minimum threshold range from 8% in Lima to 36% in Sierra and 12.3% in Urban Coast to 41% in Rural Sierra. Thus, Peru's poor are concentrated in Sierra and Selva, rather than the Coast, and in rural areas rather than urban centers.

An index of poverty, I, [Sen (1973) and Anand (1977)] is the product of (i) the percentage of population below the poverty line, and (ii) the poverty gap, or the extent to which the mean income of the poor needs to be raised to bring them up to the poverty line.

$$I = \frac{N_1}{N} \cdot \frac{Y^* - Y_p}{Y_p}, \tag{1}$$

Table 3

Regional distribution of poor: Comparison of a national with alternative regional poverty levels.

	Regions					Areas	
	Peru	Lima	Coast	Sierra	Selva	Urban Coast	Rural Sierra
1. *National* absolute poverty							
Expenditure level	4575	4575	4575	4575	4575	4575	4575
% below	28.0	3.8	19.2	42.5	29.4	9.6	53.4
Number (millions)	3.84	0.12	0.61	2.71	0.40	0.08	2.19
2. *Regional* absolute poverty							
Expenditure level: Low	4575	6172	4792	3767	4437	5245	3445
% below	28.0	8.1	20.5	35.8	28.6	12.3	41.4
Number (millions)	3.84	0.26	0.65	2.28	0.39	0.10	1.70
3. *Regional* absolute poverty							
Expenditure level: Medium	5521	7658	5757	4449	5355	6428	3975
% below	31.4	14.2	27.2	41.7	34.0	20.3	47.5
Number (millions)	5.5	0.46	0.86	2.66	0.46	0.17	1.95
4. Minimum wage	4767	6658	5100	3765	4753	4956	3445
% below	28.5	9.8	22.4	35.8	30.5	10.7	41.4
Number (millions)	3.9	0.32	0.71	2.28	0.41	0.09	1.70

Table 4

Poverty index based on 'low' regional absolute poverty levels (soles).

	Regions					Areas	
	Peru	Lima	Coast	Sierra	Selva	Urban Coast	Rural Sierra
1. Absolute poverty 'income' level[a]	2869	5172	3825	1739	2222	4187	1591
2. Percent of population with incomes below	28.0	8.1	20.5	35.8	28.6	12.3	41.4
3. Median income of poor	1342	3926	2730	847	1231	2597	755
4. Poverty gap	1527	1246	1095	892	991	1590	836
5. Gap as % of median income of poor	114	32	40	105	81	60	111
6. Poverty index *I*	32	3	8	38	23	8	46
7. Average income	9400	20,000	9205	4681	6605	12,300	4100
8. Gap as % of average income of the region	16	6	13	19	15	13	30
9. Poverty index *I'*	5	0.48	2.5	7	4	1.6	8

[a]Note that these 'income' estimates have been adjusted downwards from the expenditure estimates in table 3, row 2, in order to make them comparable with the income distribution data (see section 4, first paragraph).

Table 5

Poverty index based on single national absolute poverty level: 4575 soles.

	Regions					Areas	
	Peru	Lima	Coast	Sierra	Selva	Urban Coast	Rural Sierra
1. Absolute poverty 'income' level[a]	2869	3834	3652	2112	2292	3652	2112
2. Percent of population with incomes below	28.0	3.8	19.2	42.5	29.4	9.6	53.4
3. Median income of poor	1342	2962	2665	1009	1262	2276	1000
4. Poverty gap	1527	872	987	1103	11030	1376	1112
5. Gap as % of median income of poor	114	29	37	109	82	60	111
6. Poverty index I	32	1	7	46	24	6	59
7. Average income	9400	20,000	9205	4681	6605	12,300	4100
8. Gap as % average income of the region	16	4	11	24	16	11	27
9. Poverty index I'	5	0.15	2	10	5	1	14

[a]Note that these 'income' estimates have been adjusted downwards from the expenditure estimates in table 3, row 2, in order to make them comparable with the income distribution data (see section 4, first paragraph).

where N is the total population, Y^* the poverty line, N_1 the number of people in poverty, Y_p the mean income of the poor.

In calculating this index for Peru, the median income of the poor was used instead of their mean income, because data on the latter were not readily available. Table 4 shows the poverty lines for the different parts of Peru (row 1) and the median income of the poor (row 3), and percent of population with incomes below the poverty lines (row 3). The difference between rows 1 and 3 is the poverty gap shown in row 4. The extent to which the incomes of the poor will have to be increased in order to eliminate poverty is indicated by the ratio of the poverty gap to median income — row 5.

The core of the poverty problem in the country as a whole is indicated by both elements of poverty index I given by row 6, viz., 'how many people are poor?' (row 2) and 'how poor are they?' (row 4). According to the 'low' definition of poverty, 28% of the national population are poor, and nationally, the income of these people needs to be raised by 114%. In other words, the income of the average poor person in Peru would need to be more than doubled to bring him up to the poverty line.

Poverty index I may be modified by expressing the poverty gap as a fraction of mean income of the region, Y, rather than that of the poor, Y_p. The poverty index I', in row 9 of table 4, is computed in this way, by multiplying the percentage of the region's population defined as poor (row 2) by the poverty gap to enable all residents to have incomes at or above the poverty level. The calculations, based on the 'low' i.e. the most conservative definition of poverty, are shown in row 9. The national figure of 5% indicates the relative size of the poverty problem. For the Coastal regions excluding Lima, the value of the index is 2.5%, while that for Urban Coast is 1.6%. This implies that the value of the index for rural areas of the Coastal region would be about 3% (calculated by using population weights of the areas). For Sierra, the overall figure is 7%, that for rural areas 8% and that implied for urban areas about 5%. Thus poverty is not just a rural problem. These indices of poverty, however, imply that the Coast as a whole, and Lima in particular, are clearly better off than Sierra or Selva.

Table 5 shows the results obtained when the various poverty indices are calculated using the single national poverty level, (from row 1, table 3). These figures give substantially different and biased results. The results in table 5, in general indicate more dramatic inter-locational differences compared to those in table 4. They overstate the extent of poverty in Sierra, Selva and Rural areas and understate it in the Coast and Urban areas. For example, the indices for Lima are more than 200% below and that for Rural Sierra about 75% above those obtained by using regional estimates.

The findings of this study on Peru suggest that it is important to construct and use spatial price indices in the measurement of poverty. To do so for other developing countries, an approach similar to the one outlined in this

paper could be used. In many of these countries, one should be able to construct regional non-food price indices (if they are not available) from information on non-food expenditures. And, depending on the availability of data and time, many of the assumptions made in this paper for the case of Peru could be relaxed.

A more precise measure of spatial differences in the food cost than that given in this paper would result from the use of location-specific baskets of food items. Further, in combining the prices of the various food items into one price index, it would be better to use the expenditure weights in each location, rather than a single representative weight as done in this paper. Similarly, in adding the food and non-food price indices into an overall price index, the use of regional expenditure weights, as opposed to a single national weight, could improve the accuracy of the results. Keeping in mind the implications given earlier of using a national average income elasticity, alternative regional income elasticities could be tried in the construction of the non-food price index. Finally, if data were obtained and used that relate to expenditures at lower income ranges rather than at the mean, the accuracy of the poverty measures would improve.

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