The Poverty Line--A Pilot Survey in Europe

Bernard Van Praag; Theo Goedhart; Arie Kapteyn

The Review of Economics and Statistics, Vol. 62, No. 3. (Aug., 1980), pp. 461-465.

model was unable to track the movement in the real wage rate in that year was not too surprising in light of the distortions caused by the agricultural situation and OPEC's actions. In order to eliminate the effects of these supply shocks and provide a "cleaner" test of the hypothesis, a dummy variable, taking a value of 1.0 in 1974 and 0.0 in all other periods, was added to the regression model. The results were as follows (t-statistics in parentheses):

$$(W/\dot{P})_t = 2.848 \quad - \quad .092\,\dot{Q}_t - 8.244\,DUM1974$$
$$(9.278)\ (-2.240)\quad (-7.112)$$
$$\bar{R}^2 = .713 \qquad D.W. = 1.599. \tag{1}$$

The estimated β, equal to -0.092, was significant at the 5% level, thus supporting the hypothesis of a negative correlation between changes in the real wage rate, properly defined, and output.

While the Durbin-Watson test does not reject the null hypothesis of zero autocorrelation of the residuals, this test is compromised by not being very powerful in some important situations.[5] The use of a Cochrane-Orcutt correction produced a large value for the estimated autocorrelation coefficient, $\hat{\rho}$, and an improvement in the test statistics.[6] The results were as follows:

$$(W/\dot{P})_t = 2.695 - \quad .134\,\dot{Q}_t - 6.139\,DUM1974$$
$$(4.281)\ (-3.813)\quad (-6.837)$$
$$\bar{R}^2 = .750 \qquad D.W. = 1.940 \qquad \hat{\rho} = .650. \tag{2}$$

The estimated β of -0.134 was significant at the 1% level, adding further support for the hypothesis.

It must be noted that both of the adjustments, a fixed-weighted wage rate and a dummy variable, were necessary for β to be statistically significant. Regressions that used either a fixed-weighted wage rate without a dummy variable or a variable-weighted wage rate (as in Otani's work) with or without a dummy variable produced β's that were insignificant. These results suggest that recent data for the United States do offer support for the hypothesis of the countercyclical movement of the real wage rate.

---

[5] See Maddala (1977), pp. 286–287, for a brief discussion of this point.

[6] This is consistent with the findings of Griliches and Rao (1969). Using Monte Carlo methods with samples of size 20, they found that, in the presence of autocorrelated errors, OLS is less efficient than other estimation methods. This inefficiency was especially acute when the absolute value of ρ, estimated here as 0.650, was greater than 0.30.

REFERENCES

Bodkin, Ronald G., "Real Wages and Cyclical Variations in Employment: A Reexamination of the Evidence," *Canadian Journal of Economics* 2 (Aug. 1969), 353–374.

Dunlop, John T., "The Movement of Real and Money Wage Rates," *Economic Journal* 48 (Sept. 1938), 413–434.

Federal Reserve System, Board of Governors, *Federal Reserve Bulletin* (various issues).

Griliches, Zvi, and P. Rao, "Small-sample Properties of Several Two-stage Regression Methods in the Context of Autocorrelated Errors," *Journal of the American Statistical Association* 64 (Mar. 1969), 253–272.

Klein, Lawrence R., and Richard M. Young, *An Introduction To Econometric Forecasting and Forecasting Models* (Lexington, MA: D.C. Heath and Co., 1980).

Kuh, Edwin, "Unemployment, Production Functions, and Effective Demand," *Journal of Political Economy* 74 (June 1966), 238–249.

Lacker, Jeffrey, "Gross Output Price Deflators," Memorandum, Annual Model Project, Wharton Econometric Forecasting Associates (1978).

Maddala, G. S., *Econometrics* (New York: McGraw-Hill, 1977).

Otani, Ichiro, "Real Wages and Business Cycles Revisited," this REVIEW 60 (May 1978), 301–304.

Ruggles, Richard, "The Relative Movements of Real and Money Wage Rates," *Quarterly Journal of Economics* 54 (Nov. 1940), 130–149.

Tarshis, Lorie, "Changes in Real and Money Wages," *Economic Journal* 49 (Mar. 1939), 150–154.

U.S. Department of Commerce, Social and Economic Statistics Administration, *Dictionary of Economic and Statistical Terms* (1972).

U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings* (various issues).

THE POVERTY LINE—A PILOT SURVEY IN EUROPE

Bernard van Praag, Theo Goedhart, and Arie Kapteyn*

I. Introduction

In Goedhart, Halberstadt, Kapteyn and Van Praag (1977) a new method to define and estimate a national

poverty line was developed and subsequently applied to a large Dutch data set. In the present paper we apply

this method to small samples drawn in the member countries of the European Community in May 1976. In section II we briefly describe the method and in section III we discuss the data and the operationalization. In section IV we present the empirical results for the European countries. Section V concludes. Since the first sections cover material presented in the earlier article, we restrict ourselves to a sketchy description of the method and concentrate on the new empirical results.

II. The Poverty Line Defined

There are several definitions of a poverty line. This illustrates that poverty is not a natural condition which is objectively identifiable. Unlike most authors on the subject (e.g., Rowntree (1901), Orshansky (1968)), who take objective criteria for poverty as their point of departure, we will assume that individuals themselves are the best judge of their own situation. We call a family *poor* when its after-tax income y restricts consumption so severely that its members feel *they cannot make ends meet for their family*. We call the income level which is the family's borderline between feeling poor and non-poor the *minimum-income*, y_{min}, needed for that family. It follows that the minimum income needed to make ends meet varies over families. Assume that y_{min} can be explained by characteristics like current net income y, family size fs, and possibly by other variables like age, housing, health, working conditions, etc., where we denote the latter variables as components of a vector x; then we can identify the households[1] that cannot make ends meet as belonging to the set $\{(y,fs,x)|y_{min}(y,fs,x) > y\}$. In the same way for families that can make ends meet, there holds $y_{min}(y,fs,x) < y$. For families just on the borderline there will hold $y_{min}(y,fs,x) = y$. Hence a *national poverty line* y^*_{min} for households of type (fs,x) may then be identified with the solution of the equation

$$y_{min}(y^*_{min},fs,x) = y^*_{min}. \qquad (1)$$

Notice that this yields a poverty line differentiated with respect to various types of households. Hence (1) defines properly speaking a poverty contour. On the basis of estimates of the function $y_{min}(\cdot)$ we shall derive poverty lines for the nine member countries of the European Community.

The definition of this poverty line concept depends on what people themselves consider to be the minimum income in their circumstances. But does this

term represent the same feeling of welfare to everyone? Some people may identify it with the margin of starvation while others may define their minimum income on a less austere basis.

In order to gather additional evidence on the feelings of welfare associated with an individual's minimum income we estimate for each respondent his or her *individual welfare function of income* (WFI), denoted by $U(y)$. An individual's WFI can be considered as a cardinal utility function of income. It describes how the individual evaluates income levels on a $[0,1]$-scale. Its measurement method has been described in a number of earlier papers (e.g., Van Praag (1971), Van Praag and Kapteyn (1973)), along with a number of results on the explanation of differences in WFIs between individuals and families. WFIs have hitherto been estimated for about 20,000 individuals in Europe (see, e.g., Van Herwaarden, Kapteyn, Van Praag (1977)). For any details we refer to the papers mentioned.

The question which is of interest in this context is whether $U(y_{min})$ varies systematically for various family types or whether it is approximately constant, apart from random variation. If the latter is true, we may consider y_{min}, even if it varies over individuals in money terms, as representing a constant welfare level and hence having the same meaning across households.

III. Data and Operationalization

In May 1976, the European Community (EC) conducted a survey of income, living conditions, and perception of poverty as an appendix to the regular EC-survey of the European citizens' attitudes towards the EC, the so-called Euro-barometer (cf. Rabier (1977) and Riffault and Rabier (1977)). The Euro-barometer survey is a regularly held oral survey of European citizens. The sample size is about 1,000 in each country, except in Luxemburg and Northern Ireland, where the sample size is about 300. The samples in each country were drawn and the interviews were held by national opinion poll agencies. The questions used in the present analysis were contained in a questionnaire which was left behind with the respondent. The questionnaire had to be filled out by the respondent afterwards, and to be mailed in a pre-stamped postage cover.

The response rates were rather low. On average, 32% of the respondents returned the written questionnaire. Not all of these were completely filled out. In total we could use 1,889 (22%) questionnaires from the various countries. From other surveys, however, we know that sending reminders and, if necessary, revisiting individuals may double the response rate. Also, in view of the pilot nature of the survey, the low

---

[1] We use the words "family size" and "household size" indiscriminately. Since in our empirical work we have per family only one member's opinion on y_{min} we have to take this response as representative of the family (see also the wording of the question in section III). Hence, if we talk about an individual's minimum income then this is also the family's minimum income.

response rates are not too disturbing. The results have to be interpreted with some care, however.

One of the questions in the questionnaire is the so-called *minimum income question*:

> We would like you to tell us the absolute *minimum* income of money for a household such as yours—in other words, a sum below which you couldn't make ends meet.

> For my household I would say that the absolute minimum money income necessary after tax would be:

> £_____per week   1
>   per month   2 (ring appropriate number)
>   per year   3

The answer to this question is our measurement of the respondent's minimum income, y_{min}. On the basis of earlier findings with Dutch data the following regression was run per country:

$$\ln y_{min} = \alpha_0 + \alpha_1 \ln fs + \alpha_2 \ln y + \epsilon, \qquad (2)$$

where for convenience the subscript referring to the unit of observation has been suppressed; fs is the number of persons in the household, y the family's net income and ϵ an error term. The ϵ's are assumed to be *i.i.d.*, that is mutually *i*ndependent and *i*dentically *d*istributed.

Equation (2) represents the operationalization of the function $y_{min}(y,fs,x)$ occurring in (1). The vector of characteristics, x, is part of the error term. Thus we ignore possible differentiations of the poverty line with respect to the elements of x. This neglect is motivated by the modest sample sizes in each country. By next ignoring ϵ, we obtain the national poverty line by setting y and y_{min} equal to each other in (2) (cf. (1)):

$$\ln y^*_{min} = \frac{\alpha_0 + \alpha_1 \ln fs}{1 - \alpha_2}. \qquad (3)$$

The questionnaire also contained questions to measure a respondent's WFI, $U(y)$. As before we refer to earlier papers for a description of the measurement procedure and an explanation of the WFI concept. It is sufficient here to recall that $U(y)$ is approximately lognormal:

$$U(y) \approx \Lambda(y;\mu,\sigma) \equiv N(\ln y; \mu,\sigma), \qquad (4)$$

where $\Lambda(\cdot;\mu,\sigma)$ denotes the lognormal distribution function with parameters μ and σ and $N(\cdot;\mu,\sigma)$ the normal distribution mean μ and variance σ^2. The parameters μ and σ differ between individuals. The empirical work so far has been capable of explaining only a small proportion of the variation in σ over individuals (about 7% due to reference group influences, Kapteyn, Van Praag, Van Herwaarden (1976)). Since, in particular, σ does not correlate with the variables of interest in this paper, fs and y, we take σ as exogenous.

In earlier research we found that μ is fairly well explained by the regression

$$\mu = \beta_0 + \beta_1 \ln fs + \beta_2 \ln y + \eta, \qquad (5)$$

where η is an i.i.d. error term. Hence, applying lognormal arithmetic (see Aitchison and Brown (1957)) and omitting the error term we find that an individual evaluates his minimum income y_{min} by

$$U(y_{min}) = \Lambda(y_{min} \cdot e^{-\mu};0,\sigma)$$
$$= \Lambda(\exp(\alpha_0 + \alpha_1 \ln fs + \alpha_2 \ln y - \beta_0$$
$$- \beta_1 \ln fs - \beta_2 \ln y); 0,\sigma). \qquad (6)$$

It is easily seen that if $\alpha_1 = \beta_1$ and $\alpha_2 = \beta_2$, $U(y_{min})$ does not depend on the family size fs nor on the income y of a specific family. In other words, the welfare evaluation attached to y_{min} would not vary systematically with income and family size, even though y_{min} varies systematically according to (2).

IV. Results

In table 1, the regression estimates of equations (2) and (5) are presented with their standard errors, together with the respective sample sizes, correlation coefficients and the average value of σ per country.

The hypothesis that $\alpha_1 = \beta_1$ and $\alpha_2 = \beta_2$ per country has been tested by a Chow-test (see, e.g., Maddala (1977), pp. 198 ff.). The hypothesis could not be rejected for each of the ten countries separately nor, using adapted forms of (2) and (5) with additive dummies included, for the ten countries together. This suggests that the minimum income is identified with approximately the same welfare level by all individuals (apart from variations in σ), irrespective of differences in family size and income level. This in turn supports the intersubjective nature of the poverty line definition given by (1) and operationalized by (3).

In table 2 the poverty lines, differentiated with respect to family size, are presented for all countries together with the corresponding welfare levels. The welfare levels are by definition equal to $\Lambda(\exp(-\beta_0 - \beta_1 \ln fs + (1 - \beta_2) \ln y^*_{min});0,\sigma)$, where σ has been taken to be equal to the sample average per country. The money amounts are given in U.S. dollars.

Obviously, the exchange rates give a rather inaccurate reflection of real purchasing power. Nevertheless table 2 has some indicative value. Taking the dollar amounts at face value suggests that the Danish poverty line is the highest one in Europe and the British poverty line the lowest one. It is also interesting to compare the computed poverty lines to the average income in each country. The ratio of y^*_{min} of a four-person family to the average income in the sample of such a family is given in the last column of table 2. It appears that in the six countries where the average four-person

TABLE 1.—ESTIMATED RELATIONS FOR MINIMUM INCOME AND WELFARE PARAMETER μ, AND MEAN VALUE OF σ

Country	N	Equation (2)				Equation (5)				$\bar{\sigma}$
		α_0	α_1	α_2	R^2	β_0	β_1	β_2	R^2	
Netherlands	207	4.67	0.14	0.48	.47	5.23	0.11	0.44	.48	0.41
		(0.46)	(0.04)	(0.05)		(0.40)	(0.04)	(0.04)		(0.17)[a]
Belgium	157	6.79	0.25	0.42	.59	7.41	0.21	0.38	.55	0.48
		(0.63)	(0.05)	(0.05)		(0.60)	(0.05)	(0.05)		(0.21)
Luxemburg	15	5.83	0.04	0.51	.18	5.98	0.06	0.50	.35	0.65
		(4.46)	(0.31)	(0.35)		(2.81)	(0.19)	(0.22)		(0.27)
France	264	4.12	0.08	0.58	.56	3.97	0.00	0.61	.60	0.57
		(0.37)	(0.04)	(0.04)		(0.34)	(0.04)	(0.03)		(0.21)
Italy	115	5.97	0.38	0.22	.30	5.73	0.16	0.25	.25	0.99
		(0.46)	(0.09)	(0.06)		(0.39)	(0.08)	(0.05)		(0.31)
Germany	410	4.97	0.23	0.45	.45	5.82	0.22	0.37	.42	0.55
		(0.31)	(0.04)	(0.03)		(0.29)	(0.03)	(0.03)		(0.24)
Denmark	323	3.75	0.22	0.62	.65	4.55	0.17	0.56	.55	0.50
		(0.33)	(0.04)	(0.03)		(0.36)	(0.04)	(0.03)		(0.23)
United Kingdom	230	2.80	0.11	0.60	.59	3.30	0.10	0.54	.55	0.57
		(0.31)	(0.04)	(0.04)		(0.30)	(0.04)	(0.04)		(0.22)
Ireland	120	3.02	0.22	0.56	.55	3.57	0.14	0.50	.57	0.65
		(0.45)	(0.07)	(0.06)		(0.36)	(0.05)	(0.05)		(0.23)
N. Ireland	48	4.35	0.21	0.39	.44	3.57	0.17	0.49	.55	0.60
		(0.76)	(0.09)	(0.10)		(0.68)	(0.08)	(0.09)		(0.18)

Note: Standard errors are in parentheses.
[a] Sample standard deviation of σ.

family income is between \$11,000 and \$14,000[2] this ratio does not exceed one half, whereas in the remaining four countries, where this average income is between \$4,400 and \$6,500[3] the poverty line is much nearer to average income (with the exception of the United Kingdom).

For a more thorough explanation of the differences

[2] These countries are The Netherlands, Belgium, Luxemburg, France, Germany, Denmark.

[3] Italy, United Kingdom, Ireland, Northern Ireland.

TABLE 2.—ESTIMATED POVERTY LINES AND ASSOCIATED WELFARE LEVELS IN THE EUROPEAN COMMUNITY (MAY 1976)

Country and Number of Respondents		Family Size							$y_{min}/\bar{y}$ for $fs = 4$
		1	2	3	4	5	6	7	
Netherlands	poverty line[a]	3140	3774	4203	4537	4814	5052	5264	.37
207	welfare level	0.36	0.39	0.41	0.41	0.43	0.43	0.44	
Belgium	poverty line	3207	4325	5153	5834	6424	6951	7429	.43
157	welfare level	0.41	0.45	0.47	0.48	0.50	0.50	0.51	
Luxemburg	poverty line	4161	4407	4557	4667	4754	4827	4889	.40
15	welfare level	0.53	0.52	0.52	0.51	0.51	0.51	0.50	
France	poverty line	4207	4750	5152	5458	5707	5920	6105	.44
264	welfare level	0.40	0.44	0.46	0.48	0.49	0.50	0.51	
Italy	poverty line	2524	3548	4330	4989	5565	6086	6565	.78
115	welfare level	0.53	0.59	0.62	0.64	0.66	0.68	0.69	
Germany	poverty line	3126	4187	4968	5608	6161	6647	7100	.51
410	welfare level	0.38	0.40	0.41	0.42	0.42	0.43	0.43	
Denmark	poverty line	3084	4596	5804	6846	7788	8650	9453	.50
323	welfare level	0.37	0.41	0.44	0.46	0.48	0.49	0.50	
United Kingdom	poverty line	2020	2446	2736	2962	3151	3313	3457	.49
230	welfare level	0.47	0.49	0.50	0.50	0.51	0.51	0.52	
Ireland	poverty line	1763	2503	3072	3553	3976	4360	4714	.77
120	welfare level	0.49	0.49	0.52	0.54	0.55	0.56	0.58	
N. Ireland	poverty line	2257	2866	3296	3640	3931	4185	4414	.69
48	welfare level	0.56	0.56	0.56	0.56	0.56	0.56	0.57	

[a] Expressed in U.S. \$ per year, exchange rate May 1976.

between the countries one needs more information about differences in tax structure and social security regulations per country. Furthermore, additional differentiations, like whether the spouse of the main bread-winner works or not, whether respondents live in rural areas or not, should be incorporated into the analysis. In the present exploratory stage and with our limited data we have abstained from such an analysis.

The poverty lines defined by our method accords with individual citizen's views on poverty. Thus an official poverty line established according to this method is probably also politically acceptable. Still, if politicians do not accept the welfare level associated with the poverty line, $U(y^*_{min})$, for instance because they find it too low, then the WFI-concept may be used to define poverty lines which meet a certain minimum welfare requirement. For example, if politicians in the countries of the EC decide that no citizen should experience a welfare level below 0.5, then (4) and (5) can be used to derive a "politically acceptable" poverty line y^*_p, say. The quantity y^*_p is then the solution of

$$U(y^*_p) = \Lambda(\exp(\ln y^*_p - \beta_0 - \beta_1 \ln fs - \beta_2 \ln y^*_p); 0, \sigma) = 0.5. \quad (7)$$

In table 3 these politically determined poverty lines are presented for the various countries (with σ once again fixed at the sample average per country). Of course, political poverty lines can be derived for any other prescribed welfare level.

V. Conclusion

In this paper we presented an analytical definition of the poverty line. Estimation results were given for the member-countries of the European Community, differentiated as to family size. Differentiation according to other variables (the vector x in (1)) is in principle

possible. The limited sample sizes did not allow for such a differentiation in the present paper.

With respect to the reliability of the estimation results we express a caveat in view of the fact that the samples are possibly not sufficiently representative of the national populations. Moreover, additional methodological research needs to be done regarding the survey technique. Only more extensive surveys comprising more information and allowing for a more elaborate analysis will yield outcomes which are sufficiently reliable to serve as a basis for policy recommendations. The outcomes reported are encouraging in that already the small-scale pilot survey yields sensible results. In particular, we hope to have shown that this type of survey, if properly analysed, can serve as a viable source of policy information. In October 1979 a rather large-scale European survey along the same lines will be carried out which is expected to yield more reliable outcomes.

REFERENCES

Aitchison, J. and J. A. C. Brown, *The Lognormal Distribution* (London: Cambridge University Press, 1957).

Goedhart, Theo, V. Halberstadt, Arie Kapteyn, and Bernard M. S. van Praag, "The Poverty Line: Concept and Measurement," *The Journal of Human Resources* 12 (1977), 503–520.

Kapteyn, Arie, Bernard M. S. van Praag, and F. G. van Herwaarden, *Individual Welfare Functions and Social Reference Spaces,* Leyden University, Center for Research in Public Economics, Report 76.01 (1976).

Maddala, G. S., *Econometrics* (New York: McGraw Hill, 1977).

Orshansky, M., "Counting the Poor: Another Look at the Poverty Profile," in L. A. Ferman, J. L. Kornbluh, and A. Haber (eds.), *Poverty in America* (Ann Arbor: University of Michigan Press, 1968).

Rabier, J. R., "European Surveys and Social Research," *European Journal of Political Research* 5 (1977), 103–114.

Riffault, H., and J. R. Rabier, *The Perception of Poverty in Europe,* Commission of the European Community, Brussels (1977).

Rowntree, B. F., *Poverty, A Study of Town Life* (London: McMillan, 1901).

Van Herwaarden, F. G., Arie Kapteyn, Bernard M. S. van Praag, "Twelve Thousand Individual Welfare Functions: A Comparison of Six Samples in Belgium and The Netherlands," *European Economic Review* 9 (1977), 283–300.

Van Praag, Bernard M. S., *Individual Welfare Functions and Consumer Behavior* (Amsterdam: North-Holland Publishing Company, 1968).

———, "The Welfare Function of Income in Belgium: An Empirical Investigation," *European Economic Review* 2 (1971), 337–369.

Van Praag, Bernard M. S., and Arie Kapteyn, "Further Evidence on the Individual Welfare Function of Income: An Empirical Investigation in the Netherlands," *European Economic Review* 4 (1973), 33–62.

TABLE 3.—POLITICALLY DETERMINED POVERTY LINES, CORRESPONDING TO THE WELFARE LEVEL 0.5[a]

Country	Family Size						
	1	2	3	4	5	6	7
Netherlands	4077	4462	5011	5289	5515	5707	5875
Belgium	3807	4789	5478	6025	6488	6891	7252
Luxemburg	3761	4111	4331	4493	4624	4733	4828
France	6016	5943	5900	5870	5847	5828	5813
Italy	2294	2653	2889	3069	3216	3341	3452
Germany	4112	5265	6085	6742	7301	7791	8231
Denmark	4508	5857	6827	7610	8279	8869	9401
United Kingdom	2198	2540	2764	2935	3074	3193	3298
Ireland	2148	2604	2914	3156	3358	3532	3687
N. Ireland	1899	2395	2744	3021	3255	3460	3644

[a] U.S. $ per year, exchange rate May 1976.