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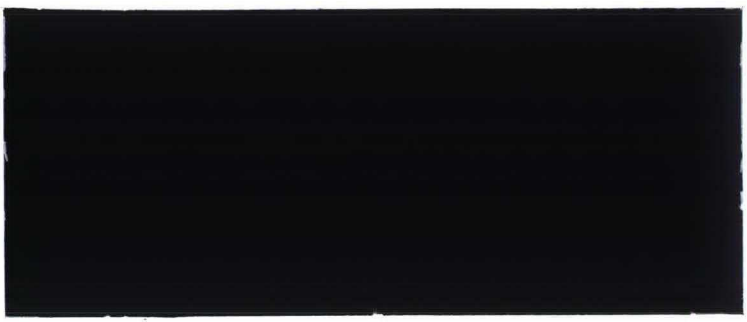

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RESEARCH MEMORANDUM

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THE EFFECT OF SYSTEMATIC MISPERCEPTION OF INCOME ON THE SUBJECTIVE POVERTY LINE

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The Effect of Systematic Misperception of Income on the Subjective Poverty Line

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Abstract

Heads of households appear to misperceive their own household income. This misperception of income can be easily assessed, but also asks for some adjustment of the answers to subjective questions where household income serves as a frame of reference. The appropriate extent of adjustment can be estimated. However, it seems more natural to explain the unadjusted answers directly by both misperceived income and accurately measured income. The results show that adjustment of the answer to the so-called Minimum Income Question proportionate to the income misperception, as advocated by Kapteyn et al. (1988), causes an overestimation of the related Subjective Poverty Line for a one-person household and less pronounced household composition effects. The results, from estimated correction and in the case of direct use of misperceived income, are similar.

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1 Introduction

Empirical evidence indicates that respondents misperceive their own household after tax income (See Kapteyn et al., 1988). Respondents appear to underestimate their household after tax income. As will be explained below, this underestimation turns out to have a downwards biasing effect on the subjective poverty line in empirical implementation. In Kapteyn et al. (1988), a method is presented to remedy this bias. One can adjust the responses to subjective questions if these questions are preceded by a question which measures the respondent's perception of his household after tax income. The misperception of income can be calculated from a comparison of the respondent's perception of the income with the measurement of income as the sum of a lengthy list of components. Next the responses to the subjective questions can be corrected. An alternative is of course to avoid the misperception, by prefacing the subjective questions with the detailed questions about household income components. Here, the focus is on the former case.

Kapteyn et al. (1988) assume that the answers to the subjective questions are biased in the same proportion as income is underestimated by the respondent. In this note, this assumption is tested within the context of the so-called Subjective Poverty Line (SPL). (See Goedhart et al., 1977). Section 2 concisely introduces the SPL concept. Section 3 presents the adjustment procedure as proposed in Kapteyn et al. (1988) and indicates how their assumption can be empirically relaxed[1]. An alternative assumption is also given through more direct use of the measurement of the respondent's perception of income in explaining subjective answers. Section 4 contains the estimation results. For comparison the same specification as in Kapteyn et al. (1988) is adopted. Section 5 concludes.

2 The Subjective Poverty Line

The SPL was introduced in Goedhart et al. (1977). It is called 'Subjective' because it springs from the respondents' answers to a survey question, the Minimum Income Question (MIQ). The MIQ runs as follows:

> Which after tax income for your household do you, in your circumstances, consider to be absolutely minimal? That is to say that with less you could not make both ends meet.

The MIQ answer, given by the head of household n, is referred to as the respondent's minimum income $y_{min,n}$.

The SPL is operationalized by specifying a relation between $y_{min,n}$ on the one hand and household income and a vector of household characteristics on the other hand. To facilitate comparison, the SPL equation will initially be specified as in

[1]This was suggested by a referee of Kapteyn et al. (1988).

Kapteyn et al. (1988):

$$\begin{aligned}\ln y_{min,n} &= \alpha_0 + \alpha_1(1-\alpha_2)fc_n + \psi(1-\alpha_2)fc_n \ln y_n + \alpha_2 \ln y_n \\ &\quad +(1-\alpha_2)m_n - \alpha_1(1-\alpha_2)hc_n - \psi(1-\alpha_2)hc_n m_n + \epsilon_n \end{aligned} \quad (1)$$

where

fc_n	composition of household n
y_n	household after tax income
m_n	mean ln income in the reference group of household n
hc_n	mean household composition in the reference group of household n
ϵ_n	error term

Household composition is specified such that account is taken of both the number of persons in the household and their ages:

$$fc_n = 1 + \ln fs_n + f(a_1) + \sum_{j=2}^{fs_n} f(a_j) \ln(j/j-1) \quad (2)$$

where

fs_n	number of persons in household n	
$f(a_j)$	$= 0$	$a_j > 18$
$f(a_j)$	$= \gamma_2(18-a_j)^2 + \gamma_3(18-a_j)^2(36+a_j)$	$0 \leq a_j \leq 18$

where a_j refers to the age of person j and γ_2 and γ_3 are parameters to be estimated.

From equation (1), $y_{min,n}$ can be written as a function of y_n, for given values of the other variables on the RHS, as set out in Figure 1. The MIQ answers are aggregated into the SPL by the following reasoning. Suppose one obtains an income to the right of $y^*_{min,n}$ in Figure 1. Take the corresponding minimum income level and return it as income. Through an iterated habituation process that person will end up in the fixed point of the function set out in Figure 1. The SPL is defined by this fixed point of that function, $y^*_{min,n}$, which equals

$$\exp \frac{\alpha_0 + \alpha_1(1-\alpha_2)fc_n + (1-\alpha_2)m_n - \alpha_1(1-\alpha_2)hc_n - \psi(1-\alpha_2)hc_n m_n}{(1-\alpha_2)(1-\psi fc_n)} \quad (3)$$

The income level y^*_{min} is the point where a household can just make both ends meet. Eventually, a household is not able to manage with less income and with more income it is. Having estimated the parametersin equation (1), the SPL can be evaluated for various household compositions.

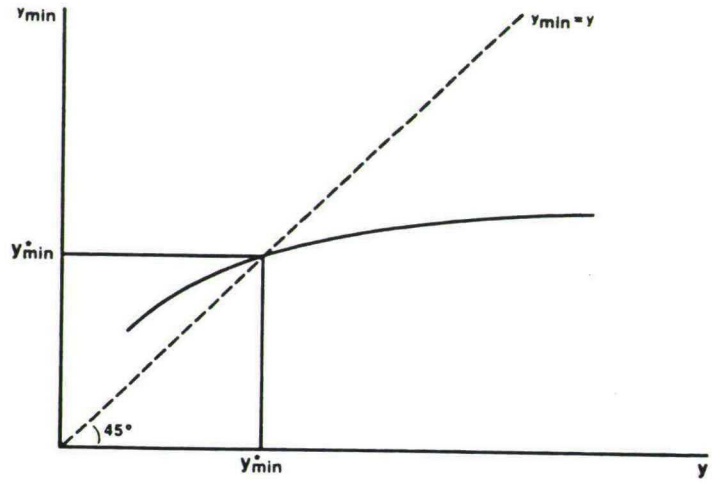

FIGURE 1: The Subjective Poverty Line y^*_{min}

3 Adjusting for Downward Bias

In the definition of the SPL, the respondent's income appears to be a crucial variable. So it is important to know which estimate of his own household income the respondent has in mind when answering the MIQ. If the respondent underestimates this income, it is likely that he will also underestimate $y_{min,n}$. As mentioned before, the factor of downward bias can be calculated from comparison between the respondent's estimate of income and a more accurate measurement of income. Just before the MIQ in the survey, the respondent's perception of his household after tax income is measured by the following question where the respondent can choose out of seven income brackets:

> Can you indicate roughly what the total after tax income of your household has been during the past 12 months? Less than Dfl. 17,500; 17,500–20,000; 20,000 – 24,000; 24,000 – 28,000; 28,000 – 34,000; 34,000 – 43,000; 43,000 or more.

Table I reflects the underestimation of household income.

In order to analyze the systematic difference in Table I between the results from the two income measures, Kapteyn et al. postulate the following relation between income y^*_n, the answer to the income question in brackets, and the income components y_{ni} $(i = 1, \ldots, I)$ recorded at the end of the questionnaire

$$y^*_n = \left(\sum_{i=1}^{I} \beta_i y_{ni} \right) e^{\eta_n} \tag{4}$$

TABLE I: COMPARISON OF TWO INCOME MEASURES

Income Bracket			Average Income	N_b
	<	17,500	17,201	564
17,500	–	20,000	25,085	355
20,000	–	24,000	28,690	521
24,000	–	28,000	32,128	632
28,000	–	34,000	38,305	635
34,000	–	43,000	45,412	686
	>	43,000	65,006	698

Dfl. per year. The second column gives the average income of all households in the corresponding income bracket according to the detailed measurement of income. N_b heads the number of respondents in the income bracket. SEP Oct86.

where the β_i's are parameters to be estimated and η_n is a normally distributed error term with mean zero and variance σ_η^2. The values of β_i are expected to lie in the unit interval [0,1]. The smaller a parameter β_i, the more the respondents 'forget' the ith income component in response to the income question in brackets. The parameters β_i and σ_η^2 can be estimated by means of maximum likelihood.

Denote the factor of underestimation by g_n. The parameters β_i being estimated, this factor can be evaluated as $g_n = \sum_{i=1}^{I} y_{ni} / \sum_{i=1}^{I} \hat{\beta}_i y_{ni}$. Kapteyn et al. now assume that the respondent underestimates his minimum income $y_{min,n}$ by the same proportion as his current income y_n. It is however not entirely obvious why the adjustment of y_{min} should be proportionate to the underestimation of y, for in equation (1) y_{min} and y are not linearly related. Moreover it appears that the extent to which y_{min} should be corrected, can be estimated. After substituting the adjusted value $y_{min,n} g_n^\delta$ for $y_{min,n}$, equation (1) becomes

$$\begin{aligned} \ln y_{min,n} &= -\delta \ln g_n + \alpha_0 + \alpha_1(1-\alpha_2) f c_n + \psi(1-\alpha_2) f c_n \ln y_n + \alpha_2 \ln y_n \\ &\quad + (1-\alpha_2) m_n - \alpha_1(1-\alpha_2) h c_n - \psi(1-\alpha_2) h c_n m_n + \epsilon_n \end{aligned} \tag{5}$$

where δ indicates the extent of adjustment. Note that δ is identified so that it is possible to test whether proportional adjustment is appropriate, i.e. $\delta = 1$ vs. $\delta \neq 1$.

From equation (1) readily an alternative specification suggests itself. In the response to the MIQ, income serves as a frame of reference. This is represented by $\ln y_n$ in equation (1). However, $\ln y_n^*$ seems a more natural candidate to capture this frame of reference, or perhaps a combination of $\ln y_n$ and $\ln y_n^*$ is best. So the alternative specification reads

$$\begin{aligned}\ln y_{min,n} &= \alpha_0 + \alpha_1(1-\alpha_2)fc_n + (\psi(1-\alpha_2)fc_n + \alpha_2)((1-\lambda)\ln y_n + \lambda \ln y_n^*) \\ &\quad +(1-\alpha_2)m_n - \alpha_1(1-\alpha_2)hc_n - \psi(1-\alpha_2)hc_n m_n + \epsilon_n \qquad (6)\end{aligned}$$

The equations (5) and (6) are identical if $\ln g_n = \ln y_n - \ln y_n^*$ and $\delta = \lambda(\psi(1-\alpha_2)fc_n + \alpha_2)$. For equation (5), $\ln y_{min,n} + \delta \ln g_n$ is substituted for $\ln y_{min,n}$ in equation (1) and for equation (6), $\ln y_n$ in equation (1) is replaced by $(1-\lambda)\ln y_n + \lambda \ln y_n^*$. In estimation, equation (6) results in special cases of equation (5). The concurrences are tabulated in terms of δ and λ in Table III.

TABLE II: CONCURRING SPECIFICATIONS

δ	λ
0	0
$\hat{\lambda}(\psi(1-\alpha_2)fc_n + \alpha_2)$	$\hat{\lambda}$
$\psi(1-\alpha_2)fc_n + \alpha_2$	1
$\hat{\delta}$	-
1	-

In the next section, the estimation results are given for both equation (5) and (6). Assuming that ϵ_n and η_n are independent and follow a normal distribution the parameters are estimated by maximizing the loglikelihood

$$L = \sum_{n=1}^{N} \left(\ln P_n - \frac{1}{2}\ln(\sigma_\epsilon^2 + \delta^2\sigma_\eta^2) - \frac{1}{2}\frac{e_n^2}{\sigma_\epsilon^2 + \delta^2\sigma_\eta^2} \right) \qquad (7)$$

where

$$\begin{aligned}P_n &= \Phi\left(\frac{\ln ub_n - \ln \sum_{i=1}^{I} \beta_i y_{ni} - \frac{\delta\sigma_\eta^2}{\sigma_\epsilon^2+\delta^2\sigma_\eta^2} * e_n}{\sigma_\epsilon\sigma_\eta/\sqrt{\sigma_\epsilon^2 + \delta^2\sigma_\eta^2}} \right) \\ &\quad -\Phi\left(\frac{\ln lb_n - \ln \sum_{i=1}^{I} \beta_i y_{ni} - \frac{\delta\sigma_\eta^2}{\sigma_\epsilon^2+\delta^2\sigma_\eta^2} * e_n}{\sigma_\epsilon\sigma_\eta/\sqrt{\sigma_\epsilon^2 + \delta^2\sigma_\eta^2}} \right)\end{aligned}$$

where $e_n = \epsilon_n + \delta\eta_n$, Φ is the cumulative standard normal distribution function and ub_n and lb_n are respectively the upper and lower bound of the income bracket y_n^* is part of.

4 Estimation results

The data are from the October 1986 wave of the Social Economic Panel survey conducted by the Netherlands Central Bureau of Statistics. Table III lists the income components distinguished, y_{ni}.

TABLE III: INCOME COMPONENTS

Head of household's wages, salaries, benefits	β_1
Head of household's fringe benefits	β_2
Rent subsidies	β_3
Household allowances	β_4
Profits, employer's contribution to health insurance premiums, scholarships	β_5
Head of household's other income	β_6
Spouse's income	β_7
Eldest child's income	β_8
Other household members' income	β_9

Table IV presents the estimation results for equations (4) and (5). The estimated parameters $\hat{\beta}_i$ indicate that the head of household's wages etc. appear to be recalled almost completely. Components like incomes of children and other household members, rent subsidies and head of household's other income are often forgotten.

Clearly, the hypothesis $\delta = 1$ has to be rejected. A striking result is that $\delta = 0$ performs even better than $\delta = 1$. The three columns in the middle do not manifest much within difference. The estimation result $\lambda > 1$ is difficult to interpret. At a high significance level ($\chi^2_{1;0.01} = 6.63$) however, the restriction $\lambda = 1$ holds, which signifies that only income as perceived by the head of the household, y^*_n, is the frame of reference when completing the survey.

To compare the results between the columns in Table IV, Figure 2 presents the five corresponding age functions $f(age)$ and Table IV exhibits the implied poverty lines for various household compositions. The poverty lines have been computed with m_n and hs_n set equal to their sample means.

Except for $\delta = 0$, the age functions look rather similar. Although the age functions show a dip, the poverty lines in Table V rise when household size in number of persons increases. Household size in number of persons compensates the age dips below zero. For $\delta = 1$, i.e. overadjustment of $\ln y_{min,n}$ according to Table IV, the poverty line for a one-person household appears to be overestimated with respect to δ unrestricted. Similarly the economies of scale are overestimated in this case.

Just for comparison the last column of Table V contains the levels of the statutory poverty line for the selected household compositions. The levels are based on the Social Assistance Act and include holiday and family allowances. The steeper household composition compensation does offset the lower starting level of a one-person

TABLE IV: ESTIMATION RESULTS EQUATIONS (4) AND (5)

δ	0	$\lambda(\psi(1-\alpha_2)fc_n+\alpha_2)$	0.40(0.02)	1
λ	0	1.11(0.05)	1	-	-
$\hat{\alpha}_0$	-0.43(0.03)	-0.38(0.01)	-0.39(0.01)	-0.38(0.01)	-0.30(0.01)
$\hat{\alpha}_1$	3.88(0.78)	-0.12(0.25)	-0.13(0.25)	0.48(0.32)	-2.00(0.21)
$\hat{\alpha}_2$	0.54(0.04)	0.34(0.03)	0.35(0.03)	0.39(0.03)	0.29(0.04)
$\hat{\gamma}_2$	0.05(0.01)	0.03(0.01)	0.03(0.01)	0.03(0.01)	0.03(0.01)
$\hat{\gamma}_3$	$-1*10^{-3}$	$-1*10^{-3}$	$-1*10^{-3}$	$-1*10^{-3}$	$-1*10^{-3}$
	$(3*10^{-4})$	$(2*10^{-4})$	$(3*10^{-4})$	$(3*10^{-4})$	$(2*10^{-4})$
$\hat{\psi}$	-0.35(0.07)	0.03(0.02)	0.03(0.02)	-0.03(0.03)	0.21(0.02)
$\hat{\beta}_1$	0.91(0.01)	0.91(0.01)	0.90(0.01)	0.90(0.01)	0.90(0.01)
$\hat{\beta}_2$	0.95(0.07)	0.77(0.06)	0.78(0.06)	0.79(0.06)	0.84(0.04)
$\hat{\beta}_3$	0.39(0.08)	0.42(0.08)	0.41(0.08)	0.42(0.08)	0.63(0.08)
$\hat{\beta}_4$	0.44(0.07)	0.79(0.07)	0.79(0.07)	0.78(0.07)	0.75(0.06)
$\hat{\beta}_5$	0.73(0.02)	0.68(0.02)	0.68(0.02)	0.68(0.02)	0.69(0.02)
$\hat{\beta}_6$	0.45(0.03)	0.45(0.03)	0.45(0.03)	0.45(0.03)	0.48(0.03)
$\hat{\beta}_7$	0.87(0.02)	0.90(0.02)	0.90(0.02)	0.90(0.02)	0.86(0.02)
$\hat{\beta}_8$	0.43(0.03)	0.42(0.03)	0.42(0.03)	0.42(0.03)	0.41(0.03)
$\hat{\beta}_9$	0.48(0.04)	0.48(0.05)	0.48(0.05)	0.48(0.05)	0.48(0.04)
$\hat{\sigma}_\epsilon$	0.31(0.003)	0.29(0.003)	0.29(0.003)	0.29(0.003)	0.31(0.004)
$\hat{\sigma}_\eta$	0.29(0.004)	0.30(0.004)	0.30(0.004)	0.29(0.003)	0.29(0.004)
L	-3543.6	-3312.2	-3315.3	-3312.5	-3803.0

$N = 4091$, standard errors in parentheses.

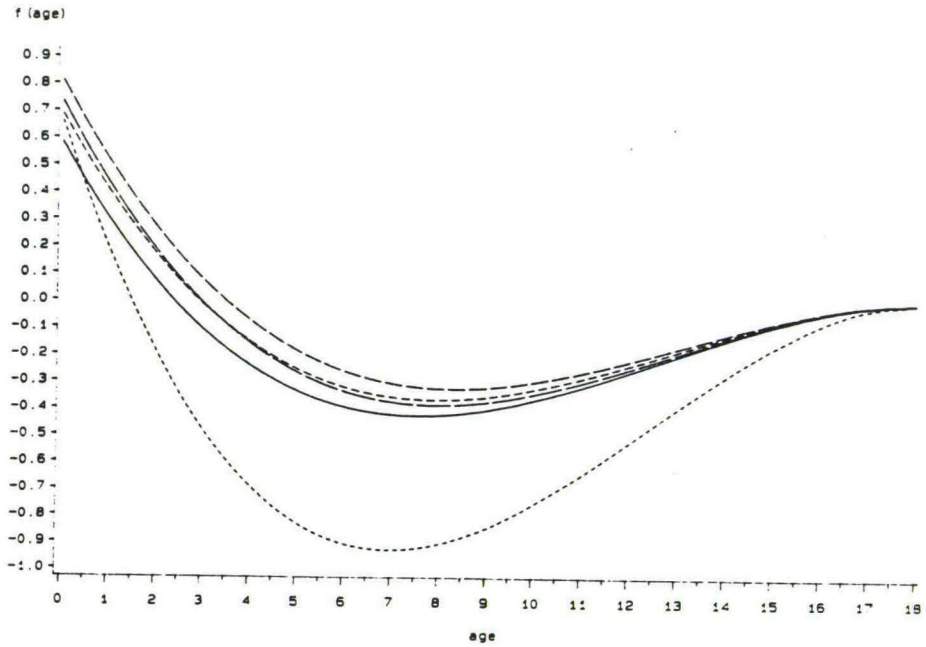

FIGURE 2: Age Functions, - - $\delta = 0$, - - $\lambda = \hat{\lambda}$, — — $\lambda = 1$, — — $\delta = \hat{\delta}$, — $\delta = 1$.

TABLE V: POVERTY LINES

Household Composition	$\delta = 0$	$\lambda = \hat{\lambda}$	$\lambda = 1$	$\delta = \hat{\delta}$	$\delta = 1$	Statutory Poverty Line
1 Adult	14,239	15,310	15,181	15,091	15,489	13,218
2 Adults	18,095	17,415	17,091	17,537	16,387	18,882
2 Adults + 6	18,298	18,359	18,017	18,564	16,832	19,963
2 Adults + 12	19,100	18,481	18,070	18,702	16,942	20,233
2 Adults + 12,6	19,240	19,199	18,772	19,462	17,337	22,071
2 Adults + 12,6,1	20,575	20,430	19,969	20,788	18,158	23,360
2 Adults + 12,6,2,1	21,222	21,290	20,811	21,681	18,834	24,933
2 Adults + 18,12,6,1	21,996	21,335	20,742	21,723	19,000	28,281

Dfl. per year.

household. The statutory poverty line levels end up to be higher than the subjective poverty line levels for all selected household compositions, except for the first one, no matter the specification.

5 Conclusions

If in a questionnaire, the Minimum Income Question is not preceded by detailed questions on household income to avoid misperception of this income by the head of the household when answering the MIQ, the answer should be corrected. Prefacing the MIQ with a measure of the perception of household income enables adjustment in explaining the answer to the MIQ. If one prefers to adjust the answers, it is possible to estimate the appropriate size of adjustment. Also the measurement of perceived income may be used more directly in explaining the MIQ answers. Either approach shows that adjustment proportionate to income misperception leads to both an overestimation of the Subjective Poverty Line for a one-person household and an overestimation of the economies of scale with an increasing number of household members.

References

GOEDHART, T., V. HALBERSTADT, A. KAPTEYN, AND B.M.S. VAN PRAAG. 1977. "The Poverty Line: Concept and Measurement." *The Journal of Human Recources* 12(4):503-20.

KAPTEYN, A., P. KOOREMAN, AND R. WILLEMSE. 1988. "Some Methodological Issues in the Implementation of Subjective Poverty Definitions." *The Journal of Human Recources* 23(2):222-42.

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