Decomposition of Socio-economic Determination of Income-related Health Inequality by Health Dimensions

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Discussion Papers on Business and Economics
No. 8/2006

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ISBN 87-91657-07-5

Decomposition of socio-economic determination of income-related health inequality by health dimensions.

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Abstract.

When analysing income-related inequality in health, it is commonly ignored that the results may vary by different dimensions of health. The present study applies recently suggested methodologies to measure income-related inequality in the overall index of the 15D instrument as well as the contributions from each of its 15 dimensions. Further, the relative impact of socio-demographic determinants on income-related health inequality is measured using established methodology. These two methodologies are integrated in order to decompose the contributions from socio-economic determinants to each of the 15 dimensions. It is found that these relative contributions vary substantially across dimensions. For policy purposes this information indicates on which aspects of health there are potential improvements in inequalities in health.

JEL classification: D30; D31; I10; I12.

Keywords: Inequality; health; 15D; decomposition; Finland.

Introduction.

The concentration index has become a standard tool for the measurement of income-related health inequality in a single health variable (see [1] for an extensive review). While such analyses provide an overall measure of income-related inequality in health, it is often useful to analyse at a disaggregated level to understand the sources of inequality. This can be done in two complementary ways. First, inequality in health stems from inequality in the determinants of health as measured by socio-economic determinants, and it is thus relevant to decompose inequality in health into relative contributions from these determinants. Methodology for such analyses has been well established ([2]; [3]; [4]; [5]; [6]). Second, inequality in an overall measure of health such as the 15D is naturally ascribed to inequality emerging from each of its dimensions ([7]; [8]). The purpose of the present study is to integrate these two approaches, so that the contribution from determinants to overall health inequality is decomposed into relative contributions via each dimension of health.

To our knowledge, only one similar study has been done earlier, but with a restricted methodological approach [8]. They decomposed the overall inequality of the physical functioning of the SF-36 into inequality in each of the ten items along lines similar to those applied in the present paper. When decomposing the contribution of socio-demographic determinants into contributions to the inequality of each single component, the methods of [8] were restricted to one-way ANOVA, whereby contributions of population subgroups (divided according to values of a one-dimensional socio-demographic determinant) were analysed. They analysed the impact of employment status, specified as employed versus non-employed (i.e., 2 groups) and the impact of income, specified as income deciles (i.e., 10 groups). This

approach has two major limitations. First, the effect of one socio-demographic determinant is not adjusted for the effects of other determinants; in this case the effect of employment status is not adjusted for income effect. Thus, due to the obvious correlation between employment status and income, the effects of these derived from one-way ANOVA may provide biased conclusions. This shortcoming may be remedied by using K-way ANOVA comprised of K classifying determinants with interaction. However, such a procedure may easily fail due to the strong imbalance of the K-way classification; for example, one may hardly expect to find unemployed in the high-income deciles. A further shortcoming of the K-way ANOVA is its inapplicability to continuous determinants. Both shortcomings are avoided by using the multivariate regression approach that is proposed in the present study. A further advantage of the regression approach is that it facilitates a decomposition of the impact of each single determinant on inequality in a health dimension into *i)* its regressive impact on variation in the health dimension, and *ii)* the impact due to income-related inequality in the determinant itself [5].

The 15D instrument

The basic idea behind the development of the 15D was to develop a generic, multidimensional, standardised, self-administered measure of health-related quality of life, which could be used primarily as a single index measure, but also as a profile measure ([9]; [10]; [11]). The present 15D questionnaire includes the following 15 dimensions: breathing, mental function, speech (communication), vision, mobility, usual activities, vitality, hearing, eating, elimination (i.e. bladder and/or bowel function), sleeping, distress, discomfort and symptoms, sexual activity, and depression. Each dimension is divided into 5 levels, by which more or less

of the attribute is distinguished. The questionnaire is provided in detail in ([9]; [10]; [11]).

The valuation system of the 15D is based on an application of the multi-attribute utility theory. A set of utility or preference weights, elicited from the general public through a valuation procedure is used in an additive aggregation formula to generate the 15D score (single index number) over all the dimensions. The maximum score is 1 (no problems on any dimensions) and the minimum score is 0 (being dead). Thus, the 15D score is defined as

$$y = \Sigma_j I_{jk} w_{jk} = \Sigma_j D_{jk} = \Sigma_j y_j \qquad (1)$$

where $I_{jk}=I_{jk}(z_{jk})$ is the average relative importance people attach to dimension j (j=1, .., 15) at level k (k=1, .., 5) and $w_{jk}=w_{jk}(z_{jk})$ is the average value people place on level k of dimension j.

The 15D was developed to meet a number of requirements set for a useful generic measure ([12]; [13]; [14]; [15]). These can be condensed into *feasibility and general applicability*; *reliability*; and *sensitivity*. A number of studies provide evidence that the 15D index meets these requirements; see the summary in [11]. Thus, it is to be expected that conclusions based on investigating the 15D index should be general and hold true for other index measures, which meet the above requirements.

Methods

Decomposition of the concentration index by component

When the 15D score for respondent *i*, say y_i, is composed as a weighted sum of 15 dimensions, say y_{i1}, .. , y_{i15}, the concentration index for y can be decomposed into components as [7]

$$C = \Sigma_{j=1..15}\, w_j C_j \qquad (2)$$

where C is the (income-related) concentration index for y, C_j the (income-related) concentration index for dimension *j*, and the weight for dimension *j* is provided by $w_j = \mu_j / \mu$, with μ and μ_j being the mean of y and y_j, respectively, y_j being the importance weight score for dimension j. Hence, C is a weighted average of the concentration indices on each of the dimensions.

For y the concentration index can be calculated as [2]

$$C = 2*\mathrm{cov}(y,R)/\mu \qquad (3)$$

where R is the fractional income rank defined for individual *i* as

$$R_i = (r_i - ½)/N \qquad (4)$$

with r_i defined as the unconditional income rank for individual *i*. Alternatively, C can be

calculated using a regression approach [2]

$$(2\sigma_R^2/\mu)y_i = \alpha + \beta R_i + u_i \quad (5)$$

where σ_R^2 is the variance of R. The estimate of β is then equal to C. Using the regression approach, approximate standard errors and t-values for the calculated C values are readily obtained from the regression output ([3]; see [2] for exact standard errors accounting for serial correlation in the errors of (5)).

Predicting and decomposing inequality by socio-demographic determinants

For policy purposes it is important to quantify the contributions of various determinants of health to their degrees of inequality. Assuming that health is linked to K determinants through a linear regression,

$$y_i = \Sigma_k \delta_k x_{ik} + \varepsilon_i \quad (6)$$

the concentration index, C, for y can be decomposed as (see [5] for a formal proof)

$$C = \Sigma_k (\delta_k \mu_k/\mu)C_k + (1/\mu)CG_\varepsilon = \Sigma_k \eta_k C_k + (1/\mu)CG_\varepsilon = C^{PRED} + CG^{(\varepsilon)} \quad (7)$$

where μ is the mean of y, μ_k the mean of x_k, C_k the income-related concentration index for x_k, and CG_ε the generalized concentration index for ε, see [5]. Equation (7) shows that C can be thought of as consisting of two components: A deterministic component equal to the weighted

sum of concentration indices of the *k* determinants, where the weight of C_k is simply the elasticity of y with respect to x_k, i.e. $\eta_k = (\delta_k \mu_k/\mu)$, and a residual unexplained inequality captured by the last term, $CG^{(\varepsilon)}$. The decomposition further shows how the separate contribution of each determinant to inequality in health can be separated into three sources: (i) its effect on health (δ_k) (ii) its mean in population (μ_k) and (iii) its association with income rank (C_k).

The decomposition provided in (7) can be applied to any of the 15 dimensions. Thus, assuming that the dimension number *j*, $j = 1, .., 15$, is linked to the K determinants through a linear regression,

$$y_{ji} = \Sigma_k \delta_{jk} x_{ik} + \varepsilon_{ji} \qquad (8)$$

the concentration index for dimension number *j* can be decomposed using (7) as

$$C_j = \Sigma_k (\delta_{jk}\mu_k/\mu_j)C_k + (1/\mu_j)CG_{\varepsilon j} = \Sigma_k \eta_{jk} C_k + (1/\mu_j)CG_{\varepsilon j} . \qquad (9)$$

Combining (2), (8) and (9) leads to the following decomposition of C:

$$\begin{aligned} C &= \Sigma_j w_j C_j = \Sigma_j w_j [\, \Sigma_k (\delta_{jk}\mu_k/\mu_j)C_k + (1/\mu_j)CG_{\varepsilon j} \,] \\ &= \Sigma_{j,k} (\mu_j/\mu)\delta_{jk}(\mu_k/\mu_j)C_k + \Sigma_j (\mu_j/\mu)(1/\mu_j)CG_{\varepsilon j} \\ &= \Sigma_{j,k} (\mu_k/\mu)\delta_{jk} C_k + \Sigma_j (1/\mu)CG_{\varepsilon j} \\ &= C^{PRED} + CG^{(\varepsilon)} . \end{aligned} \qquad (10)$$

The decomposition in equation (10) deviates from that in (7) by expressing the deterministic component of C as a weighted sum of the deterministic components from each of the 15 dimensions. Rewriting (7) and (10) respectively as

$$C = \Sigma_k (\mu_k/\mu)C_k (\delta_k)+ (1/\mu)CG_\varepsilon \quad (11)$$

and

$$C = \Sigma_k (\mu_k /\mu)C_k (\Sigma_j\delta_{jk}) + (1/\mu)\Sigma_j CG_{\varepsilon j} \quad (12)$$

and using the standard OLS assumption that C_j^{PRED} and $CG_{\varepsilon j}$ are orthogonal, it follows that CG_ε equals $\Sigma_j CG_{\varepsilon j}$, so that the two definitions of C^{PRED} given by (7) and (10) are equal.

The strategy of the present paper is to apply the decomposition (9) for each of the 15 dimensions in the 15D measure, in order to quantify the relative contribution of each determinant to C_j for each of the 15 dimensions as well as to the overall C for the 15D score as provided by (10). It is hypothesised that the determinants may have different effects on different dimensions.

Data

The data are based on the Finnish Health Care Survey in 1995/1996, which is a national representative cross-sectional sample of the total non-institutionalised population [16]. The interviews were conducted face-to-face to ensure reliability of data and achieve a high

response rate. After the interview, a questionnaire with the 15D instrument was given to a randomly selected reference person of the household. The 15D data were available from this one person per household. The present study applies a subset of 3,695 cases (aged 15 to 92) for which the 15D data were available. The overall response rate was 87.2 per cent. The 15D score was obtained by using the importance weights and level values from a representative sample of the Finnish population as described above ([9]; [10]; [11]).

Following recent practice [6], determinants of the regressions are the respondent's income (log of net household income in Finnish Mark, adjusted for household composition, using the approach suggested by [17] with both parameters equal to 0.5, that is, equivalent household income per person equals the square root of number of adults plus 0.5 multiplied by number of children), age, gender, activity status (employed, self-employed, student, unemployed, social disability pensioned, old age retired, house worker, and economically inactive), educational level (high, if university degree, medium, if senior secondary school, technical college qualification or vocational school qualification fulfilled, and low otherwise), and marital status (married, divorced/separated, widowed, and unmarried). The eventual interaction effects of age and gender as well as non-linearity in the age effect are captured by specifying age categories (-30, 31-45, 46-60, 61-70, and 71-) for each gender.

Results

Table 1 shows simple statistics for each of the 15 dimensions and the 15D score (mean, standard deviation, and minimum and maximum values). It further shows concentration indices and their standard deviations. The weight of each dimension and the contribution of

the inequality of each dimension to the inequality in 15D score are reported according to the decomposition in formula (2). For ease of interpretation, these contributions are further expressed as percentages of the concentration index for the 15D score.

The contribution to the 15D score via mean value of each dimension (weighted by importance weight) is seen from the column “mean”. It varies from 0.0492 for pain and depression to 0.0771 for breathing, which is 57 percent higher. On the other hand, the variation of the dimensions across the sample (as expressed by standard deviation, minimum and maximum) is more substantial. The smallest standard deviation is for hearing (0.0035) while the largest is for mental function (0.0172). The ranges confirm this, being narrow for hearing and wide for breathing. Regarding income-related inequality, the overall concentration index of 0.0117 is comparable to results obtained for Denmark by [6]. Further, the concentration indices show that inequality is largest for usual activities, pain and mental functioning (C larger than 0.02), while smallest for eating, hearing, communication (C less than 0.005) with the overall 15D score inequality located in-between at a C value of 0.0117. With respect to contribution to overall inequality, usual activities and mental function are the strongest contributors, each contributing more than 14 percent of inequality in the 15D score. This is due to the fairly high weights (which are caused by the high means of these components) combined with their high concentration indices. As an example, the contribution of usual activities to the CI for the overall 15D score is calculated using formula (2) as the CI for usual activities multiplied by the ratio of the means of usual activities and 15D scores, i.e. as (0.0686/0.9227)*0.0227=0.0017. This contribution is further expressed as percentage of the CI for the 15D score, i.e. usual activities contributes with (0.0017/0.0117)*100% = 14.45 percent of the total inequality. Other major contributors to overall inequality are breathing

(11.9 percent), mobility (11.3 percent), pain (9.9 percent), while modest contributors are eating (1.3 percent), hearing (2.2 percent), communication (2.8 percent) and depression (2.8 percent).

The figures in Table 1 clearly illustrate that the dimensions of overall health vary substantially with respect to distributional determinants as well as magnitude of their contributions to the 15D score and its inequality.

Table 2 shows simple statistics for the determinants to be used in the regression analyses, together with their income-related concentration indices and the standard deviations for these. In particular, attention should be paid to the concentration indices which describe how each determinant is distributed across income. Thus, the positive C for males and females aged 31-45 and 46-60 indicates that the income distribution favours these groups, i.e., these groups are economically better off than the rest of the population. The significantly negative C for females 30 or less indicates that the income distribution disfavours younger females. Older females (aged 61-70 and 71-) and older males (aged 71-) are significantly worse off economically than the rest of the population. Further, it is no surprise that students, unemployed, social disability pensioned, retired and housewives are worse off economically. Self-employed do not deviate significantly from the rest of the population. Persons with lower education are economically worse off than those with medium and higher education. Those living without a partner are worse off than those who are married. Finally, the concentration index of the logarithm of income can be seen as a measure of the inequality in the income distribution.

Table 3 presents results from OLS regression of each of the 15D dimensions as well as the 15D score on the determinants. The figures shown are regression coefficients and their t values. The regressions are based on a cross section and are thus unable to address problems related to endogeneity between health and determinants as well as presence of structural common factors. Such endogeneities may well be present between health, income, work status and education. Taking this into account, however, the effects of determinants on 15D and its determinants as well as considerable variations in the magnitudes of these impacts are evident.

Apart from sleeping, eating and eliminating, income has a significant effect on the rest of the dimensions as well as on the 15D score. Housewives and inactive do not deviate significantly from employed on any dimension, while social disability pensioned and retired are significantly worse off on all dimensions. Students are better off on some dimensions (pain, communication, vitality), but do not deviate significantly on the rest or on the 15D score. Self-employed only deviate significantly on usual activities.

Unmarried are better off than married as to pain, but worse off on sleeping and communication, while no significant effects are found for the remaining dimensions or the 15D score. Divorced and separated are better off than married on usual activities, but do not deviate significantly on any other dimension or the 15D score, while widowed are better off on mental function, without significant deviation on any other dimension.

Regarding gender and age effects, the picture is somewhat complex. Young females (30 or less) are worse off than young males (30 or less) on pain, depression and vitality, but do not deviate significantly from them on any other dimension or the 15D score. Males aged 31-45

and 46-60 are worse off than males aged 30 or less on the overall 15D score, pain, sleeping, usual activities, mental function, depression and distress, while males aged 46-60 deviate on hearing, breathing, vitality, elimination and sexual activity. Males aged 61-70 also deviate significantly from young males on the overall 15D score. Turning to the dimensions, it is seen that they are worse off than young males on sleep, mental function, hearing, breathing, vitality and sexual activity. Males aged 71- are significantly worse off than young males on pain, mobility, vision, sleep, usual activities, mental function, hearing, breathing, eating, vitality, elimination and sexual activity. Females aged 31-45 are significantly worse off than males aged 30 or less on pain, sleep, depression, distress, vitality and elimination, while females aged 46-60 are significantly worse off on most dimensions, except hearing, eating, communication and sexual activity. Regarding age 61-70, females are significantly worse off on pain, mental ability, depression, vitality and elimination, but better off on communication. Finally, females aged 71- are significantly worse off on all dimensions except communication.

To summarize, it is especially interesting to see that for all age groups the effects on the overall 15D score only vary slightly across gender, while large variations are found for the single dimensions. Thus, it is evident that the 15D score conceals a complex pattern of effects in such a way that highly relevant information is ‘drained out’ during the aggregation. Therefore, it is important also to look at the 15D profile, i.e. to look at the situation on the separate dimensions.

Table 4 reports the contributions of each determinant to income-related inequality on each of the 15 dimensions as percentage of the overall predicted concentration index for 15D. For each dimension the predicted inequality component can be calculated as the simple sum of the

contributions of each determinant to it. These figures are found in the last row of the table. The last column reports the sum of the contributions of each determinant to the 15 dimensions, thus representing the contribution of the determinants to the deterministic part of the overall inequality via deterministic contribution to the dimensions.

Looking at the direct effects of the determinants, the column for C^{PRED} shows that the strongest contributors are retired, income and females older than 70. Further, looking at the contributions from health dimension, the largest contributions to health inequality comes from sexual activity, usual activities, mental ability, breathing and mobility. Thus, public health initiatives aiming at reducing health inequality should be expected to have larger effects if targeted toward retired people – especially females older than 70 – and towards low income groups. Considering health dimensions, the large inequality in sexual problems is striking and is an evident target for initiatives, together with problems related to usual activities, mobility and breathing problems. Considering the detailed contributions from each determinant to the dimensions, further targeting of public initiatives may be obtained. Thus, for the case of retired people, larger effects should be expected if policies are directed toward mobility, usual activities, mental abilities, pain, breathing and sexual activity than if directed toward vision, depression, hearing and eating. Considering females older than 70, especial attention should be devoted to mobility, usual activities, mental ability and sexual activity. Regarding low income people, especial effort should be directed toward problems related to usual activities, sexual activities, mental ability, vitality and breathing.

Conclusion

The study shows that health is a diversified matter and that the overall index of health may be too crude a measure to look at alone and demonstrates the potential gains of considering the varying importance of different dimensions of health when analysing income-related inequality in health. Thus, determination of inequality is a complex and multi-facetted matter, and the implications for political decision making or economical resource allocation may be considerable. Further, it appears that the effects of socio-demographic determinants on different dimensions of health vary considerably. It is clearly indicated that public health and social policy initiatives and programmes, aiming at reducing income-related inequality in health, should be targeted toward specific dimensions of health and toward specific population groups rather than being uniformly directed toward general health and the general population. While the study is based on cross-sectional data, the illustrated effects of determinants cannot be interpreted as causal effects. But it stands clearly out that major population subgroups, to which health inequality is connected, are retired people – especially females older than 70 – and people with low income. Finally, it appears clearly that some dimensions contribute heavier to health inequality than other. This is especially the case for problems related to sexual activity, usual activities, mental ability, breathing and mobility.

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Tables

Table 1. Statistics of the 15D by each of its 15 dimensions (n=3695).

	Mean (μ_j)	Std.	Min.	Max.	C_j	Std(C)	Weight (W_j)	Contrib. (C_jW_j)	Contrib. (pct of 15D)
Pain	0.0493	0.0150	0.0027	0.0624	0.0217	0.0029	0.0534	0.0012	9.883
Mobility	0.0657	0.0121	0.0027	0.0704	0.0186	0.0017	0.0712	0.0013	11.286
Vision	0.0498	0.0057	0.0078	0.0518	0.0081	0.0011	0.0540	0.0004	3.746
Sleeping	0.0627	0.0105	0.0091	0.0695	0.0056	0.0016	0.0680	0.0004	3.233
Usual act.	0.0686	0.0150	0.0048	0.0760	0.0227	0.0020	0.0744	0.0017	14.446
Mental	0.0767	0.0172	0.0021	0.0852	0.0200	0.0021	0.0832	0.0017	14.241
Depression	0.0492	0.0049	0.0125	0.0520	0.0060	0.0009	0.0533	0.0003	2.755
Distress	0.0562	0.0075	0.0101	0.0610	0.0058	0.0013	0.0610	0.0004	3.003
Hearing	0.0580	0.0035	0.0232	0.0590	0.0041	0.0006	0.0628	0.0003	2.223
Breathing	0.0771	0.0150	0.0065	0.0839	0.0166	0.0018	0.0835	0.0014	11.887
Eating	0.0702	0.0039	0.0090	0.0707	0.0020	0.0005	0.0761	0.0002	1.309
Communication	0.0651	0.0053	0.0156	0.0664	0.0046	0.0008	0.0706	0.0003	2.755
Vitality	0.0667	0.0114	0.0111	0.0756	0.0123	0.0016	0.0723	0.0009	7.591
Elimination	0.0558	0.0114	0.0080	0.0615	0.0093	0.0019	0.0605	0.0006	4.796
Sexual act.	0.0515	0.0081	0.0128	0.0546	0.0143	0.0015	0.0559	0.0008	6.847
15D score	0.9227	0.0950	0.3957	1.0000	0.0117	0.0010	1.0000	0.0117	100.000

Table 2. Summary statistics of determinants (n=3695).

	Mean	Std.	Min.	Max.	C	Std(C)
Log(Income)	11.2377	0.4834	7.1499	13.4478	0.0231	0.0002
Male(-30)	0.1066	0.3086	0.0000	1.0000	-0.0350	0.0276
Male(31-45)	0.1316	0.3381	0.0000	1.0000	0.1121	0.0244
Male(46-60)	0.1169	0.3214	0.0000	1.0000	0.1621	0.0260
Male(61-70)	0.0609	0.2392	0.0000	1.0000	-0.0400	0.0374
Male(71-)	0.0356	0.1854	0.0000	1.0000	-0.2910	0.0493
Female(-30)	0.1327	0.3393	0.0000	1.0000	-0.1141	0.0243
Female(31-45)	0.1620	0.3685	0.0000	1.0000	0.1004	0.0216
Female(46-60)	0.1397	0.3468	0.0000	1.0000	0.1716	0.0235
Female(61-70)	0.0655	0.2475	0.0000	1.0000	-0.2617	0.0357
Female(71-)	0.0484	0.2146	0.0000	1.0000	-0.5196	0.0414
Employed	0.4448	0.4970	0.0000	1.0000	0.2610	0.0097
Selfemployed	0.0919	0.2889	0.0000	1.0000	-0.0035	0.0299
Student	0.0903	0.2866	0.0000	1.0000	-0.1663	0.0301
Unemployed	0.1112	0.3144	0.0000	1.0000	-0.3054	0.0265
Soc.disab.pens.	0.0489	0.2158	0.0000	1.0000	-0.1186	0.0419
Retired	0.1827	0.3865	0.0000	1.0000	-0.3072	0.0195
Housewife	0.0247	0.1554	0.0000	1.0000	-0.1906	0.0597
Econ.Inact.	0.0054	0.0736	0.0000	1.0000	-0.0276	0.1288
Low Educ.	0.2950	0.4561	0.0000	1.0000	-0.1816	0.0144
Medium Educ.	0.6204	0.4853	0.0000	1.0000	0.0212	0.0074
High Educ.	0.0846	0.2783	0.0000	1.0000	0.4781	0.0303
Married	0.6523	0.4763	0.0000	1.0000	0.1123	0.0067
Divorced/Sep.	0.0721	0.2586	0.0000	1.0000	-0.3236	0.0338
Widowed	0.0595	0.2367	0.0000	1.0000	-0.3898	0.0373
Unmarried	0.2162	0.4117	0.0000	1.0000	-0.1236	0.0180
Helsinki	0.1873	0.3902	0.0000	1.0000	0.1655	0.0197
South	0.2091	0.4067	0.0000	1.0000	0.1483	0.0176
West	0.3812	0.4857	0.0000	1.0000	0.0814	0.0097
East	0.1142	0.3181	0.0000	1.0000	0.2716	0.0322
North	0.1082	0.3107	0.0000	1.0000	0.2866	0.0340

Table 3. Regression of the 15D score and its dimensions. Regression coefficients and t-values (n=3695).

	Pain	Mobil.	Vision	Sleep.	U.Act.	Mental.	Depr.	Distr.	Hear.	Breath.	Eat.	Comm.	Vital.	Elim.	Sex.Ac.	15D
Log(Income)	0.001	0.001	0.000	0.000	0.002	0.002	0.001	0.001	0.000	0.002	0.000	0.001	0.001	0.000	0.003	0.012
	2.078	1.752	2.058	0.737	4.002	2.594	3.202	3.197	1.717	2.872	0.834	2.750	3.486	0.076	2.892	4.067
Male(31-45)	-0.002	0.000	0.000	-0.003	-0.002	-0.004	-0.001	-0.002	0.000	-0.002	0.000	0.000	-0.003	-0.001	-0.002	-0.021
	-2.279	-0.304	-0.028	-3.656	-2.036	-3.201	-3.837	-4.469	-1.007	-1.697	-0.786	1.149	-3.609	-1.312	-0.917	-3.625
Male(46-60)	-0.007	-0.001	-0.001	-0.004	-0.006	-0.006	-0.002	-0.003	-0.001	-0.004	0.000	0.000	-0.006	-0.002	-0.007	-0.045
	-6.833	-1.676	-1.837	-4.990	-6.051	-4.900	-4.230	-5.197	-3.856	-3.806	0.049	0.620	-6.665	-2.833	-3.918	-7.381
Male(61-70)	-0.003	0.000	-0.001	-0.002	-0.002	-0.007	0.000	0.000	-0.001	-0.005	0.000	0.001	-0.003	-0.001	-0.010	-0.029
	-1.850	0.064	-1.504	-2.067	-1.761	-4.071	0.306	0.233	-3.710	-3.524	0.518	1.721	-2.660	-1.001	-3.861	-3.254
Male(71-)	-0.007	-0.010	-0.004	-0.005	-0.013	-0.018	-0.001	-0.001	-0.004	-0.009	-0.002	0.001	-0.008	-0.008	-0.038	-0.101
	-3.686	-6.788	-5.530	-3.802	-7.271	-7.829	-1.208	-1.272	-9.244	-4.504	-3.289	1.097	-5.017	-5.144	-11.528	-9.109
Female(-30)	-0.003	0.001	0.000	-0.001	0.000	0.000	-0.001	-0.001	0.000	-0.001	0.000	0.000	-0.002	-0.001	0.000	-0.009
	-3.418	0.817	-0.148	-1.313	0.217	-0.351	-2.508	-1.553	0.187	-1.103	-0.016	0.910	-3.098	-1.148	0.060	-1.724
Female(31-45)	-0.004	0.000	0.000	-0.002	-0.001	-0.002	-0.002	-0.002	0.000	-0.001	0.000	0.000	-0.004	-0.003	-0.003	-0.021
	-4.184	0.257	0.233	-3.121	-1.265	-1.444	-4.897	-4.728	-0.736	-1.272	-0.140	0.957	-4.925	-3.380	-1.600	-3.835
Female(46-60)	-0.008	-0.002	-0.001	-0.005	-0.004	-0.006	-0.002	-0.004	0.000	-0.004	0.000	0.001	-0.005	-0.004	-0.003	-0.046
	-7.770	-2.611	-2.682	-6.290	-4.717	-4.913	-5.869	-6.497	-1.339	-4.127	-0.033	1.664	-6.820	-4.663	-1.631	-7.864
Female(61-70)	-0.003	-0.002	-0.001	-0.003	-0.002	-0.007	-0.001	-0.001	0.000	-0.002	0.000	0.002	-0.003	-0.003	-0.001	-0.026
	-2.039	-1.548	-1.080	-2.763	-1.009	-3.764	-1.986	-1.422	0.099	-1.142	0.744	2.984	-1.963	-1.979	-0.239	-2.712
Female(71-)	-0.008	-0.014	-0.004	-0.008	-0.013	-0.013	-0.002	-0.002	-0.002	-0.008	-0.001	0.001	-0.009	-0.007	-0.022	-0.097
	-4.213	-9.338	-5.512	-5.524	-7.219	-5.801	-3.061	-1.916	-5.390	-4.120	-2.461	1.808	-5.842	-4.762	-6.736	-8.815
Selfemployed	-0.001	0.000	0.000	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	-0.005
	-1.422	-0.746	-0.597	0.028	-2.102	0.346	-0.601	-0.400	0.275	-0.376	-1.183	-0.373	-1.710	0.323	-0.346	-1.087
Student	0.002	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.002	0.001	0.002	0.009
	1.868	-0.087	0.556	0.237	0.682	0.887	-0.338	-0.436	0.648	1.189	-0.268	2.005	2.567	1.114	1.003	1.574
Unemployed	-0.001	-0.001	0.000	-0.001	-0.001	-0.002	-0.001	-0.002	0.000	-0.001	0.000	0.000	-0.001	0.000	0.001	-0.012
	-1.114	-1.688	-1.277	-2.214	-1.584	-2.706	-4.392	-4.217	-0.671	-1.579	-0.379	0.806	-0.823	-0.504	0.848	-2.650
Soc.disab.pens.	-0.016	-0.014	-0.003	-0.009	-0.025	-0.011	-0.003	-0.005	-0.002	-0.015	-0.002	-0.003	-0.011	-0.009	-0.017	-0.133
	-13.420	-15.825	-6.908	-10.722	-23.089	-8.294	-7.738	-7.521	-5.442	-12.666	-4.995	-6.518	-12.191	-9.548	-8.435	-19.816
Retired	-0.008	-0.007	-0.001	-0.003	-0.010	-0.006	-0.001	-0.002	-0.001	-0.008	-0.001	-0.002	-0.004	-0.005	-0.013	-0.063
	-5.602	-6.933	-2.031	-2.775	-7.805	-3.812	-2.653	-3.040	-3.588	-6.006	-2.435	-4.489	-4.109	-4.492	-5.588	-8.216
Housewife	0.002	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.001	0.000	0.001	-0.001	-0.001	0.000	0.002
	1.308	-0.283	0.299	0.344	0.354	-0.146	-0.681	-0.922	0.535	0.829	0.189	1.186	-0.755	-0.774	-0.051	0.198
Econ.Inact.	-0.002	0.001	0.000	-0.001	0.003	0.005	0.000	0.000	0.000	-0.001	0.000	0.002	0.002	0.000	0.004	0.010
	-0.700	0.405	0.163	-0.455	0.957	1.446	-0.017	0.126	-0.421	-0.398	0.077	1.366	0.771	0.083	0.827	0.543
Low Educ.	-0.004	-0.002	-0.001	0.001	-0.003	-0.004	0.000	0.000	-0.001	-0.003	0.000	0.000	-0.001	0.000	-0.004	-0.019
	-3.787	-2.359	-3.648	1.058	-3.928	-3.569	-0.645	0.903	-3.369	-2.843	0.356	-0.497	-1.699	-0.196	-2.557	-3.559
Medium Educ.	-0.001	0.000	0.000	0.001	-0.001	-0.002	0.000	0.001	0.000	-0.001	0.000	0.000	0.000	0.000	-0.002	-0.003
	-1.652	-0.467	-0.659	1.886	-1.071	-1.727	0.375	1.883	-1.539	-0.714	0.311	-0.166	0.583	0.303	-1.062	-0.639
Divorced/Sep.	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.003
	0.102	-0.638	-0.206	-0.117	2.837	0.055	-1.368	0.075	-1.082	1.153	0.752	-0.876	0.487	-0.141	0.975	0.561
Widowed	-0.001	-0.001	0.000	-0.001	0.000	0.003	0.000	0.001	0.000	-0.001	0.000	0.000	0.001	-0.001	0.002	0.000
	-0.451	-1.741	-0.358	-1.223	-0.014	2.253	0.040	1.086	0.135	-0.901	-0.422	0.259	0.934	-1.581	1.243	-0.062
Unmarried	0.001	0.001	0.000	-0.001	0.001	-0.001	0.000	0.000	0.000	0.001	0.000	-0.001	0.000	0.000	0.001	0.003
	2.206	1.866	1.252	-1.992	1.509	-0.818	-0.887	-0.024	0.708	1.104	0.396	-2.435	0.428	0.794	1.200	0.839
South	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.003
	0.063	-0.478	1.076	0.860	-0.903	-0.206	1.604	1.165	0.449	0.926	-0.368	1.070	0.703	1.379	0.358	0.715
West	-0.001	0.000	0.000	0.001	-0.001	-0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001

	-1.625	-0.675	0.170	1.214	-1.261	-0.766	0.828	1.996	0.643	-0.350	-0.419	0.593	0.059	0.614	-1.121	-0.350
East	-0.001	-0.001	0.000	0.001	-0.002	-0.001	0.000	0.001	0.000	-0.002	0.000	-0.001	0.000	0.000	-0.001	-0.005
	-1.740	-0.869	0.393	1.566	-2.157	-1.227	1.044	1.169	-0.239	-1.948	0.237	-1.675	0.166	0.264	-0.926	-1.091
North	-0.001	0.000	0.000	0.001	-0.001	-0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	-0.002	-0.002
	-1.677	-0.157	-0.158	1.673	-1.239	-1.113	-0.228	1.276	0.298	0.560	-0.437	-1.045	-0.416	0.836	-1.547	-0.495
R^2_{adj}	0.17	0.29	0.11	0.09	0.34	0.16	.06	0.05	0.16	0.19	0.03	0.03	0.14	0.12	0.24	0.34
F	30.59	59.46	18.49	15.82	72.57	27.17	8.53	8.16	27.03	33.14	5.49	5.33	24.94	20.27	45.52	74.62

Note. The reference person for the dummy variables is a male, aged less than 30, who is employed, highly educated and living in marriage or cohabitation in Helsinki All F tests are significant (prob<0.0001)

Table 4. Contribution from each determinant and each component to C (in % of C^{PRED}) (n=3695)

	Pain	Mobil.	Vision	Sleep.	U.Act.	Mental.	Depr.	Distr.	Hear.	Breath.	Eat.	Comm.	Vital.	Elim.	Sex.Act.	C^{PRED}
Log(Income)	2.55	1.60	0.99	0.66	4.41	3.68	1.38	2.10	0.49	3.50	0.29	1.29	3.31	0.07	5.96	32.30
Male(31-45)	-0.30	-0.03	0.00	-0.35	-0.24	-0.48	-0.18	-0.31	-0.03	-0.22	-0.03	0.06	-0.37	-0.13	-0.20	-2.82
Male(46-60)	-1.22	-0.22	-0.13	-0.65	-0.97	-1.01	-0.27	-0.50	-0.16	-0.67	0.00	0.04	-0.92	-0.40	-1.17	-8.23
Male(61-70)	0.06	0.00	0.02	0.05	0.05	0.16	0.00	0.00	0.03	0.12	0.00	-0.02	0.07	0.03	0.22	0.76
Male(71-)	0.66	0.90	0.39	0.50	1.16	1.61	0.08	0.12	0.39	0.80	0.17	-0.07	0.69	0.72	3.45	11.54
Female(-30)	0.43	-0.08	0.01	0.12	-0.02	0.05	0.11	0.10	-0.01	0.14	0.00	-0.04	0.30	0.11	-0.01	1.21
Female(31-45)	-0.58	0.03	0.01	-0.32	-0.16	-0.23	-0.24	-0.35	-0.02	-0.18	-0.01	0.05	-0.53	-0.37	-0.37	-3.28
Female(46-60)	-1.69	-0.42	-0.23	-1.00	-0.92	-1.24	-0.45	-0.76	-0.07	-0.89	0.00	0.14	-1.15	-0.80	-0.60	-10.08
Female(61-70)	0.51	0.29	0.11	0.51	0.23	1.09	0.18	0.19	-0.01	0.29	-0.05	-0.29	0.38	0.39	0.10	3.92
Female(71-)	1.81	2.98	0.93	1.73	2.78	2.88	0.46	0.44	0.54	1.76	0.30	-0.30	1.94	1.60	4.86	24.72
Selfemployed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Student	-0.24	0.01	-0.03	-0.02	-0.08	-0.13	0.02	0.03	-0.02	-0.15	0.01	-0.10	-0.26	-0.11	-0.22	-1.31
Unemployed	0.26	0.30	0.12	0.38	0.34	0.74	0.37	0.54	0.04	0.37	0.03	-0.07	0.15	0.09	-0.34	3.31
Soc.disab.pens.	0.82	0.71	0.16	0.48	1.26	0.58	0.17	0.24	0.08	0.76	0.09	0.15	0.57	0.45	0.86	7.38
Retired	3.76	3.46	0.53	1.36	4.69	2.95	0.63	1.09	0.56	3.99	0.46	1.15	2.13	2.36	6.29	35.42
Housewife	-0.08	0.01	-0.01	-0.02	-0.02	0.01	0.02	0.03	-0.01	-0.05	0.00	-0.03	0.04	0.04	0.01	-0.07
Econ.Inact.	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.02
Low Educ.	1.67	0.77	0.63	-0.34	1.55	1.82	0.10	-0.21	0.35	1.25	-0.04	0.08	0.58	0.07	1.90	10.18
Medium Educ.	-0.16	-0.03	-0.03	0.13	-0.09	-0.20	0.01	0.10	-0.04	-0.07	0.01	-0.01	0.04	0.02	-0.17	-0.47
Divorced/Sep.	-0.02	0.09	0.01	0.02	-0.47	-0.01	0.09	-0.01	0.05	-0.21	-0.04	0.06	-0.07	0.02	-0.30	-0.80
Widowed	0.10	0.30	0.03	0.21	0.00	-0.60	0.00	-0.13	-0.01	0.21	0.03	-0.02	-0.17	0.29	-0.48	-0.25
Unmarried	-0.34	-0.22	-0.08	0.23	-0.21	0.15	0.05	0.00	-0.03	-0.17	-0.02	0.15	-0.05	-0.10	-0.31	-0.96
South	0.01	-0.07	0.08	0.12	-0.16	-0.05	0.11	0.12	0.02	0.18	-0.02	0.08	0.11	0.21	0.12	0.88
West	-0.29	-0.09	0.01	0.16	-0.20	-0.16	0.05	0.19	0.03	-0.06	-0.02	0.04	0.01	0.08	-0.33	-0.58
East	-0.41	-0.15	0.04	0.27	-0.45	-0.33	0.09	0.15	-0.01	-0.45	0.02	-0.15	0.03	0.05	-0.36	-1.69
North	-0.40	-0.03	-0.01	0.29	-0.26	-0.31	-0.02	0.16	0.02	0.13	-0.03	-0.09	-0.08	0.16	-0.62	-1.09
Predicted CI	6.92	10.11	3.56	4.51	12.21	10.98	2.74	3.34	2.18	10.35	1.12	2.09	6.76	4.87	18.26	100.00