Title

Household income and health problems during a period of labour-market change and widening income inequalities – a study among the Finnish population between 1987 and 2007

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Abstract

Income inequalities widened considerably from 1987 to 2007 in Finland. We compared the

association between household income and health problems across three periods and in several

different ways of modelling the dependence. Our aim was to find out whether the change in the

distribution of income might have led to wider income-related inequalities in health problems. The

data represent an 11-per-cent random sample of the Finnish population, and we restricted the

analysed sample to those between 18 and 67 years of age and not in receipt of any pension in each

of the three six-year periods examined (n between 280,106 and 291,198). The health outcome was

sickness-allowance days compensated. Household-equivalent taxable income was applied with

two different scale transformations: firstly, as real income adjusted for price level and secondly, as

rank position on the income distribution. We used negative binomial regression models, with and

without zero inflation, as well as decomposition analysis. We found that sickness-allowance days

decreased with increasing income, while differences in the shape and magnitude of the association

were found between the scales and the periods. During the study period the association

strengthened considerably at both the lowest fifth and the top fifth of the rank scale, while the

observed per-unit effect of real income changed less. Decomposition analysis suggested that

slightly less than half of the observed increase in concentration of health problems at lower end of

the rank scale could be accounted for by the change in real income distribution. The results

indicate that widening differences in household consumption potential may have contributed to an

intensified impact of household income on inequalities in health problems. Explaining the change

only in terms of consumption potential, however, was problematic, and changes in the

interdependence of labour-market advantage and health problems are likely to contribute as well.

Background

Given that the economic resources of households, including income, are a frequently discussed potential source of inequality in health, it is of great interest to examine whether, and if so how, the association between household income and health problems changes following a change in the distribution of income among a population. A few previous studies have addressed the potential impact of change in income inequality on health differences by income, with mixed results. Data on the British population imply that an increase in health differences across the 1980s was at least partially attributable to widening income inequality (Gravelle & Sutton, 2003), but contrasting findings were reported in studies among Japanese and Spanish populations (Kachi, Inoue, Nishikitani, Tsurugano, & Yano, 2012; Regidor, Ronda, Pascual, Martínez, Calle, & Domínguez, 2006). Our previous results indicate that the inequality in health problems by household income may have widened among the Finnish population between 1995 and 2007, and in the present paper we examine in more detail the association between 1987 and 2007.

Marked changes occurred in the distribution of income among the Finnish population during the period under study. Income inequalities were particularly low in Finland between 1987 and 1991, and the Gini-coefficient for household disposable income was 0.20 in 1987 (Statistics Finland, 2011 a). The unemployment rate was relatively low as well, at 3.1 per cent (Statistics Finland, 2011 b). A deep recession was experienced in Finland between 1991 and 1993, during which time the unemployment rate rose steeply, peaking at 16.6 in 1994. Largely due to income transfers, however, inequality in household disposable income was only mildly affected during this period, while average disposable income stagnated slightly. In contrast, between 1994 and 2000, improving employment rates paralleled with increasing average income level, but the increase was less marked at the lower end of the income range, while top incomes increased particularly

rapidly, resulting in a continuous increase in relative income inequality. Between 2000 and 2007 average income level continued to rise, but the increase was more even throughout the distribution and the change in relative income inequality was less consistent. The Gini-coefficient for disposable income in 2007 was 0.28. The unemployment rate declined more or less continuously after 1994, and was 6.9 per cent in 2007.

Analytical setting and objectives of the study

Our objective in this study is to test to what degree changes in the distribution of household consumption potential could account for potential changes in health inequality by income. By consumption potential we understand the ability to buy commodities on the market. Our previous results from follow-up data on individuals suggested that household economic resources, including income and wealth, affect subsequent health problems (Aittomäki, Martikainen, Laaksonen, Lahelma, & Rahkonen, 2012), while results less clearly in support of the causal effects of consumption potential are reported in two other studies (Gunasekara, Carter, Liu, Richardson, & Blakely, 2012; Halleröd & Gustafsson, 2011).

Our approach is based on two important distinctions pertaining to income distribution and health inequality. Firstly, our main interest is on real-income difference, and not only on relative income inequality: in income metrics, it is usually accepted that a proportional increase, e.g. of 20 per-cent, in everyone's income does not constitute an increase in income inequality. From our point of view it is relevant, however, that if everyone's real income increases in same proportion, differences in terms of consumption potential increase. If ability to buy goods and the freedom for consumption choice is directly relevant for health, changes in real-income difference could be expected to affect inequalities in health even if relative income inequality, as measured e.g. by the Gini coefficient, is less affected.

Secondly, it is crucial to distinguish between the observed effect of a set quantity of real income on health problems, and the magnitude of health inequality by income among the population. The

latter can be described as the advantage observed in those with better income in terms of difference in health problems between, e.g. persons located at 1st quartile point and 3rd quartile point of the income distribution. On the assumption that differences in household consumption potential are a cause of the income-health-problems association, it is to be expected that health differences between persons located at certain rank positions in the income distribution widen particularly strongly when income inequality widens. This is because real-income difference (i.e. difference in consumption potential) between the same rank positions is widening. Changes in the effect of a set quantity of real income, in contrast, can be expected to be smaller, because the advantage afforded by a set increase in consumption potential is not necessarily, as such, affected by the income distribution.

We report data on the association between real income and health problems, as well as between rank position on the income distribution and health problems. Furthermore, a decomposition analysis is performed in an attempt to estimate to what degree potential change oberved in the latter is related to change in real-income difference. To the degree that consumption potential is a significant driver of health inequalities, we expect 1) the change in the association between rank position and health problems to be more marked than that between real income and health problems, and 2) the change in the distribution of income to account for a major part of income-related health-inequality change over time.

Methods

Data source and measurements

The data were derived from the labour-market-participation database of Statistics Finland (ethics committee permission TK 53-576-04), which combines data from several official register sources. The data set used in this study represents an 11-per-cent random sample of the entire Finnish population between 1987 and 2007. The analyses covered three periods, 1987 to 1992, 1994 to

1999 and 2002 to 2007. The health outcome was sickness allowances received. The analysed sample was restricted to those between 18 and 67 years of age and not in receipt of any pension, including disability pension, during the six years of each studied period, because persons not meeting these criteria do not qualify for sickness allowance. After excluding those with missing income data (1%), the analysed samples were 288,361, 280,106 and 291,198 persons for the three periods, respectively. All the original data were annual, except for occupational class, which was obtained from the population register every fifth year.

For each six-year period, data on income as well as on all adjusted factors were derived from the first three years, and the data on sickness allowances from the last three years. Consequently, sickness allowances in 1990-1992 were predicted by income in 1987-1989, allowances in 1997-1999 by income in 1994-1996, and allowances in 2005-2007 by income in 2002-2004. This was done in order to eliminate the short-term dependences of lower income during the time of the compensated sickness period, and temporary exit from the labour market due to acute sickness. We further deleted from the analyses persons with 30 months or more of unemployment during the three years of sickness-allowance measurement.

Sickness allowance is a universal social benefit paid by the Finnish Social Insurance Institution in compensation for medically certified inability to work. Before 1993 the allowance was paid starting on the eighth day of certified sickness, and from 1993 onwards starting on the tenth day. Employment is not required because being an entrepreneur, a job seeker, a full-time student, and doing household work count as working towards receiving the benefit. Employers paying the salary of an employee during the employee's sickness leave are entitled to claim the benefit in the place of the employee, and allowance days claimed by the employer are also included in our data. We analysed the number of sickness-allowance days during a three-year period. The proportion of the studied population receiving sickness allowance and the average number of allowance days are reported in Table 1.

(Table 1)

We measured income in terms of household taxable income derived from national taxation registers. In the original annual data the top three per cent with the highest incomes was collapsed to give the same value. We adjusted the income measure for changes of price level using the consumer price index of Statistics Finland, with the index from the year 2002 as the reference point, and for household size using the modified equivalence scale of Organisation for Economic Co-operation and Development (Förster & d'Ercole, 2009). We averaged the resulting measure across three calendar years, and used it as a real income measure. The distributions of real income in each period are shown in Figure 1. We constructed the rank-position scale by further replacing the values in euros with the cumulative prevalence of the measure. The scale expresses the ordinal rank of a person on the continuum of all persons in the population ranked according to increasing household income, on a scale from zero to one.

(Figure 1)

Confounding factors adjusted for included age, gender, education, occupational class and labour-market participation. Education was measured in terms of the highest completed degree, comparing those with college-level or higher education to those with less than college-level education. Occupational class was entered into the models in three categories: professional occupations, manual workers, and all others (including non-professional white-collar work, entrepreneurs and those without occupational data). Labour-market participation was measured as the number of years within a three-year period a person was recorded as being primarily outside the labour market, in other words not employed, self-employed or registered as a job seeker for most of the year.

Regression methods

We used negative binomial regression models and decomposition analysis based on these models. The distribution of sickness allowance is skewed, and there is a notable excess of zero observations. There are two reasons why income might affect the probability of allowance

somewhat differently from the effect on the number of days: firstly, there may be situations in which the observation of health problems is masked by a tendency to claim sickness or benefits, leading to the over-observation of zeros; secondly, different clinical conditions contribute to the probability of receiving an allowance and to the number of allowance days differently. We fitted zero-inflated models to distinguish between the probability of any allowance and the number of allowance days, and models without zero inflation in order to estimate the total effect of income.

Graphical presentation, with income categorised into tenths, allowed us to roughly examine the shape of the association in each period studied. Subsequently, we pooled the data from the three periods, and fitted models with continuous variables, modelling period changes as interaction between the income variables and the period. Furthermore, we added model terms that accounted for the change of the slope across the range of the income variables. We determined the placing of the piece-wise terms by fitting a series of models testing for different placings by thousand euro and one per-cent-unit intervals, and comparing the model fit based on the Log likelihood score. In order to enhance the readability of the results from the models with continuous variables we set the scales of the income variables at 8,522 euros of real income, corresponding to the standard deviation in the first period, and at a 25-per-cent distance on the rank position.

In order to test if potential age and cohort differences in the effect of income on sickness allowance might complicate the comparison between the periods, we fitted models including the interaction of age and real income for each period separately.

Decomposition analysis

We used decomposition analysis to quantitatively assess the contribution of change in real-income difference to change in income-related inequality in sickness allowance. In the decomposition analysis, inequality in sickness allowance is measured with concentration index, which summarises the distribution of sickness allowance across rank position on the income distribution, negative value denoting concentration at the lower end (O'Donnell, van Doorslaer, Wagstaff and

Lindelow, 2007; Wagstaff, van Doorslaer and Watanabe, 2003). Gravelle and Sutton (2003) proposed a partial concentration index, which gives the concentration adjusted for covariates, and we report the change in this index value across the periods. Decomposition formally assumes that the dependent variable can be linearly regressed on the predictors. In order to apply the method to non-linear models, O'Donnell et al. (2007) proposed to use average marginal effects instead of model estimates. We could derive these from non-zero-inflated models.

We followed the decomposition method proposed by Wagstaff, van Doorslaer and Watanabe (2003). This method gives approximations for the contributions of 1) change in the effect of the predictor on the outcome (i.e. the regression coefficient), 2) change in average level of the predictor and 3) change in relative inequality in the predictor. We were interested, in particular, in the sum of 2) and 3) above, as these together amount to the contribution of change in real-income difference. However, the approximations hold only for relatively small changes. In order to circumvent this problem, instead of comparing the three six-year periods directly, we further divided the study period into fifteen six-year periods, each advancing one year in time with respect to the previous one. Thus, we decomposed the change between the data from years 1987-1992 and that from years 1988-1993, subsequently that between data from 1988-1993 and data from 1989-1994, and so forth, making total of fourteen decompositions. The decomposition results from these one year intervals were then added up to give approximations for the change between the original three periods. To facilitate model estimation the regression models were fitted for each of the fifteen periods separately.

Results

We observed a consistent slope of decreasing sickness-allowance days for increasing income when the association was modelled without a zero-inflation part (Figure 2). Differences in sickness allowance between the extreme income categories were widest in the last period. Using models with zero-inflation the effect of income on the occurrence of any sickness allowance was

observed to be different from the effect on the number of allowance days in those with allowances (Figure 3). The effect on the number of allowance days was strongly curvilinear: the slope was steep at the low end of the range, but levelled off with rising income. In contrast, the effect on the occurrence of any allowance was modest in the first period, but was observed to be u-shaped in the second and the third periods, the highest occurrence being in mid-range incomes.

(Figure 2)

(Figure 3)

Regression of change between the three periods

We modelled the change in the dependence of sickness allowance on both income scales between the three periods, using continuous income variables (Table 2). Terms for a change in the slope were placed at points that resulted in the best model fit.

(Table 2)

Between the first and second period, the effect of real income on number of allowance days strengthened, with marked increase in the estimate at incomes below 15,000 euros, and milder change between 15,000 and 23,000 euros. Increase in the effect of rank position on the number of allowance days in the lowest 18 per-cent was considerable, and greater in magnitude than that below 15,000 euros of real income, while that between 18 and 54 per-cent quantiles was similar to that in the mid-segment of real income. In contrast, an effect in the opposite direction emerged with respect to the effect of income on probability of any allowance: in the second period, the probability of any allowance increased markedly with increasing real income up to 23,000 euros, and continued to increase, albeit with more gentle slope upto 29,000 euros. An increase in probability of allowance of similar magnitude with increasing rank position was observed upto 52-per-cent quantile, while the effect disappeared between 52 and 80 per-cent. A declining slope for increasing income remained above 80-per-cent quantile and above 29,000 euros.

Between the second and third period, the effect of real income on number of allowance days remained relatively stable, with no statistically significant change. The corresponding effect of rank position continued to increase in strength in the lowest 18 per-cent, but not in the range between 18 and 54 per-cent. With respect to probability of any sickness allowance, the u-shape association persisted, but the magnitude of the effect attenuated considerably below 23,000 euros as well as below 52 per-cent quantile. Between 52 and 80 per-cent quantiles the effect reversed again, resulting in decreasing probability of allowance for increasing rank position above the median. The effect of the decreasing probability of allowance for higher incomes above 29,000 euros remained relatively stable throughout the study period, and between the second and third periods the effect of rank position on allowance probability in the top 20 per cent increased considerably in strength.

We did not find statistically significant age differences in the effect of real income on the number of allowance days. The effect on probability of allowance was found to be slightly u-shaped for those 37 years or older already in the first period, albeit much less so than in the second period. Correspondingly, the u-shape was slightly milder for the younger age groups than those 37 years or older in the third period (data not shown).

Decomposition results

The partial concentration index of income-related inequality in sickness allowance days, adjusted for age, gender, education, occupational class and labour-market participation, was -0.061 in the first period, -0.076 in the second, and -0.126 in the third period, respectively. Relative inequality in taxable real income widened between both first and second, and second and third period, the Gini-coefficient was 0.22 in the first period, 0.26 in the second, and 0.28 in the third period, respectively, while absolute real-income difference widened more considerably between second and third period. When we fitted models without zero-inflation and derived average marginal effects of real income on sickness allowance days, the effect of real income was observed to strengthen between the second and the third period, but not between the first and second: average

marginal effect among the entire sample, scaled to 8,522 euros of annual real income, was -1.31 allowance days in the first period, -1.21 days in the second, and -2.01 in the third period, respectively.

(Table 3)

We performed decomposition of change in the concentration of sickness allowance days across rank position on the income range: the contribution of real income was found to be more marked between the second and third period than between the first and second (Table 3). Between the first and second period the increase in concentration of sickness allowance attributable to real income was found to be entirely due to widening relative income inequality. Between the second and third period, change in real-income difference contributed approximately two fifths of the total change attributable to real income, and a large part of this change was due to a rise in average real income. The contribution of widened relative income inequality was the same between the second and third period as between the first and second, but in the latter made up a much smaller part of the increased concentration of sickness allowance across the rank position range.

Discussion

We studied change in the association between household income and health problems among the Finnish population from 1987 to 2007. The focus was on comparing associations observed among the population across periods rather than following up individuals for the entire 20-year period. We made comparisons across three periods that differed with respect to economic conditions: in 1987-1989 income inequalities were relatively narrow and the unemployment rate was low; in 1994-1996 the unemployment rate was high, and inequality in taxable household-income was wider than in 1987-1989; and in 2002-2004 income inequality had widened further, although average income level was higher and unemployment rate lower than in 1994-1996. We were interested in not only relative income inequality, as measured by conventional inequality indices, but also differences in terms of absolute real income of households. Between 1996 and 2004 both of these widened considerably, but the change in real-income difference was larger in magnitude.

Our aim was to test whether the change in the distribution of real income could account for potentially widened inequality in health problems by income. We used two different income scales to examine the shape of the association in more detail, one measuring real income and the other rank position on the income distribution. On the assumption that differences in household consumption potential are causing health-inequality, we expected the inequalities in health problems by rank position to increase markedly during the period studied, but the observed per-unit effect of real income on health problems to remain relatively stable.

Confirmation of the hypothesis

The results were compatible with the hypothesis to some degree. A considerable increase in the strength of the association between the rank scale and health problems was observed in the lowest fifth and top fifth of the income distribution, and, in keeping with our hypothesis, the increase was larger than that for real income. Lack of an increase in the effect in the middle range of the rank

scale between the second and third period is partly attributable to a rise in average real income in the top three quarters of the distribution: because the effect of real income on health problems is curvilinear with a stable turning-point for the slope, a rise in average income will decrease health differences between people moving from a steep-slope range to a gentle-slope range.

Decomposition analysis suggested that slightly less than half of the increase in contribution of real income to concentration of health problems across rank position range could be accounted for by changes in the distribution of income. Between the second and third period, this change was to a larger degree due to widening absolute real-income difference, but also widening relative income inequalities contributed. However, the observed effect of real income on health problems also intensified at the low end of the range. This contrasts with our original expectation that, on the assumption that the income-health association is due to differences in consumption potential of households, the effect of real income should be comparably stable. Furthermore, the emergence of a u-shaped dependence between income and probability of any sickness allowance is unlikely to be explainable with reference to consumption potential of households alone.

Observations about the measurements

The drawback of sickness allowance as a health measure is that it is, to some degree, defined by care seeking, and might be influenced by work demands. The allowance is paid only for sickness periods of at least ten days, or eight days before the policy change in 1993, however, and can thus be considered a more accurate and reliable measure of health problems than short sickness absences from work. While previous research on sickness allowances covering entire working-age populations is scarce, the associations of sickness absence from work with several other health measures as well as mortality are reported in a number of previous studies on employed cohorts. In general, strong and consistent associations are found between sickness absences longer than eight days and self-reported health measures (Marmot, Feeney, Shipley, North and Syme, 1995; Laaksonen, Kääriä, Leino-Arjas and Lahelma, 2011) as well as between sickness absence and mortality (Vahtera, Pentti and Kivimäki, 2004; Kivimäki, Head, Ferrie, Shipley, Vahtera and

Marmot, 2003). The strength of these associations increases consistently with increasing length of absence (Marmot et al., 1995; Vahtera et al., 2004). Inequalities in sickness absence by occupational social class tend to be comparably marked (Marmot et al., 1995; Piha, Martikainen, Rahkonen, Roos and Lahelma, 2007), while those by income found in a previously studied Finnish employed cohort were slightly narrower (Piha et al., 2007).

While employment is not a requirement for receiving sickness allowance, the incentive to seek care and sickness certification may, nevertheless, be somewhat lower among the economically inactive. We did repeat the statistical analyses excluding those who were outside the labour market throughout the three-year measurement period, but the effect on the findings was small. The degree to which work conditions may have influenced the length of prescribed sick leave is probably, at least to some degree, reduced by statistical adjustment for occupational class, but some confounding may have remained. However, for a work-condition bias to influence the conclusions one would have to assume that the degree to which work demands affect the granting of sickness allowance would have increased during the study period. This was not supported in our data (not reported).

Despite strong associations with measures of long-standing health status, it may be warranted to argue that sickness allowance measures acute health problems. The implications with respect to the interpretation of our data may be two-fold. Firstly, it may be that the observed results reflect effects that are relatively short term in nature, and as a consequence the data might overestimate the change between the periods in terms of the potential long-term impact of economic resources on health. Secondly, it is also possible that sickness allowance is a measure that is particularly sensitive to change, and can detect changes in health inequalities earlier than outcomes that respond more slowly. This might mean that a corresponding increase in inequality in other outcomes will be observable after a longer time lag.

We used household taxable income to estimate consumption potential. Because many of the commonly received income transfers are taxable, the data approximate income after received

transfers, but before taxes. Ideally, disposable income with all received transfers and paid taxes accounted for would have been better, but these data were not available for the entire period under study. Some change in association between income and health might thus be attributable to changes in taxation: an increasing tax burden would tend to decrease the observed effects of taxable income if the dependence was attributable to mechanisms related to consumption, and the opposite would be the case when the burden decreases. However, taxation should primarily affect those on a high income who also pay a larger proportion of it as tax, and therefore it seems unlikely that our findings are related to taxation. Nevertheless, the relative income inequality we observed for 1994-1996 was somewhat wider than that in disposable income reported for the entire Finnish population (Statistics Finland 2011 a). Consequently, our decomposition results might somewhat overestimate the contribution of change in income inequality to the change in concentration of sickness allowance between the first and second period studied.

Limitations of the decomposition methods

Decomposition analysis assumes that the outcome can be linearly regressed on the predictors, and consequently, the application of decomposition methods to our research question and data is problematic in several ways. While non-linear regression model can perhaps be accomodated by deriving average marginal effects (as was proposed by O'Donnell et al., 2007), with respect to our data, the issue has not only to do with the link function of the model: using average marginal effects, the information of steep change of the slope of the effect is lost. Furthermore, a distinction between the effect of income on the number of sickness allowance days and that on the probability of allowance cannot be made in an analysis using marginal effects. Finally, important differences between the regression coefficients and the average marginal effects derived from the models are that 1) the prior estimates proportional difference in sickness allowance, while the latter estimates absolute difference, and 2) marginal effect is affected not only by the regression coefficient of the regressor in question, but also by all other terms in the model, including model intercept. Consequently, the increase observed for average marginal effect of real income on sickness

allowance may be partially due to a proportional increase in sickness allowance days throughout the income range.

The limitations of the decomposition analysis imply that the decomposition results might not be an entirely reliable way to quantify the degree of change attributable to changes in real-income difference as opposed to other factors that may alter the concentration of health problems across the income range. Nevertheless, it can be concluded that the partial concentration index of income-related inequality in sickness allowance confirmed that inequality in health problems across rank position on the income range widened markedly during the period studied, and that the change in real-income difference contributed to this change.

Theoretical implications and comparison with previous studies

Overall, our results suggest that change in the differences in health problems by household income reflect the development of income inequality in Finland. It seems plausible to infer that differences in the power to consume also, to some degree, cause differences in health problems. Explaining the observation of intensified income-related inequality in health problems only in terms of the distribution of consumption potential, however, was problematic.

Our hypothesis rested on the assumption that the health effect of a set quantity of household-equivalent real income would remain relatively constant even when income inequality changes if the association is attributable to consumption power. This may be an oversimplification in that the consumption needs that are potentially relevant to health might not be entirely constant over time. For example, if the availability of low-cost public services decreases, the importance of private resources could be expected to increase. Furthermore, the culture related to potentially health-promoting behaviours might change so that the consumption of some products that are beneficial to health becomes more prevalent, and consequently the health advantage associated with better economic resources becomes stronger.

A considerable number of studies have focused on finding out whether the health-inequality by income could be mainly explained by social comparison (Kafui & Kawachi, 2012; Kawachi, Adler and Dow, 2010). The theory related to these studies proposes that the income-health dependence may not be so much due to a person's ability to acquire things that are beneficial for health, but rather reflects a person's experience of whether one can acquire things one could be expected to be able to acquire. The difference between the two is very difficult to capture empirically (Kawachi, Adler and Dow, 2010; Aittomäki, Martikainen, Laaksonen, Lahelma and Rahkonen 2010), and we did not attempt to construct a measure for social comparison in our study. It is not entirely clear what kind of findings we should expect in our study setting were the income-health association to be interpreted mainly in terms of social comparison. It is perhaps possible to argue that the intensified health effect in the lower end of the real income range is related to increasing experiences of deprivation among people who lag behind in the income development. This would mean that the decomposition results for the contribution of real-income difference as opposed to change in the effect of real income might be misleading. Building on the social comparison theory, it may not be informative to separate these two statistically, because, according to the theory, the effect of income on health is a function of its distribution.

It is likely that a part of the income-health association, and a marked part of the increased strength of the dependence, is attributable to labour-market mechanisms related to health affecting employment and earnings. Studies in European countries indicate increasing exclusion of the ill from the labour market after mid-1990s (Burström, Nylén, Barr, Clayton, et al., 2012; Holland, Burström, Whitehead, Diderichsen, et al., 2011; van der Wel, Dahl & Birkelund, 2010). Furthermore, potential effects of health problems on earnings may not be limited to income loss during a period of unemployment, but might also include likelihood of rises in remuneration, particularly if these are compromised by the occurrence of even short unemployment spells.

The relationship between labour market advantage and health is particularly tricky in our study, as sickness allowances might be affected by different inclination to seek sickness certification

between the stably employed, recently re-employed, those experiencing unemployment, and those underemployed in precarious conditions. It is possible, that the emergence of a u-shaped dependence between income and probability of sickness allowance in the second period studied is to a part caused by decreasing incentive to claim sickness benefits when unemployment spells become not only much more common, but also somewhat longer. The persistence of this dependence into third period, while with less magnitude, might be to some degree maintained by increased job insecurity affecting low income jobs in particular. However, most individuals with either unemployment months or sickness allowance make transitions between working and not working, for various reasons, within a six-year period, and the explanation of the somewhat paradoxical findings from the zero-inflated models probably require a study setting in which the time sequence related to the effect of health problems on employment and earnings can be examined in more detail.

Two earlier studies applied decomposition analysis to examine the contribution of changing income distribution to health inequality by income, both observing changes in the concentration of poor one-item self-rated health. Gravelle and Sutton (2003) examined the development of income-related health inequality in Britain between 1979 and 1995. They found that the concentration of worse health in those with lower incomes increased, and that the change was driven by a change in income distribution: the effect of real income on health remained relatively constant. Secondly, Kachi, Inoue, Nishikitani, Tsurugano, & Yano (2012) compared the concentration of poor self-rated health in 1986 to that in 2007 among the Japanese population. They found that, despite increased income inequality, the concentration of health across the income range had diminished. This paralleled the considerable reduction in the observed effect of real income on health, whereas the effect of non-employment strengthened. However, income, non-employment and health were measured at the same time point, and consequently the potential effect of health on non-employment may have obscured some of the true effects of consumption potential on health.

In a different kind of study, Regidor, Ronda, Pascual, Martínez, Calle, & Domínguez (2006) compared the prevalence of disabling conditions by household income among the Spanish population between 1985 and 2000. Between these two time points, income inequalities narrowed in parallel with the general improvement in economic conditions, whereas the prevalence of morbidity fell considerably. Differences in health outcomes by income were nevertheless observed to widen among those aged 45-74 years. The authors suggest that this may have been due to the better ability of those in higher social positions to benefit from the general improvement in economic conditions. Unfortunately, they could not adjust for potential confounders other than age and gender.

Our finding that inequalities in health problems by household income widened among the Finnish population during the period under study is compatible with findings concerning mortality. Tarkiainen, Martikainen, Laaksonen, & Valkonen (2012) report a marked increase in differences in life expectancy by income, comparing mortality in 1988-1992 and 2003-2007. Several earlier studies examined socioeconomic health inequalities in the Nordic countries in the late 1980s and mid-1990s, reporting mostly relatively small changes by education and social class (Lahelma et al., 2002; Manderbacka, Lahelma, & Rahkonen, 2001; Mackenbach et al., 2003). Our results give further evidence that inequalities in health problems by household income widened only slightly immediately after the deep recession in Finland in 1991-1993, but wider differences emerged later on.

It may be that redistributive policies restricted the adverse effects of the economic crisis in the early 1990s. If so, a part of wider health inequalities observed after the mid-1990s could be related to changes in social policy: Finnish public-welfare spending underwent considerable reductions in 1993 and 1996. While potential changes in out-of-pocket health care costs alone may not be sufficiently large to explain notable changes in the income-health dependence given that the Finnish health care system is largely publicly funded, change in a number of public services may, nevertheless, significantly alter the economic conditions of households. Moreover, changes in

income transfers directly impact on the distribution of consumption potential. Although very few services and subsidies were completely abolished in the 1990s, the income transfers were significantly less generous after the reductions (Niemelä & Salminen, 2006). The degree to which income transfers narrowed income inequality was lower between 2002 and 2004 than between 1987 and 1989, despite the fact that the unemployment rate in 2002-2004 was roughly three times as high (at 9.0 per cent) as at the end of the 1980s (Statistics Finland 2011 a and b). Estimating the degree to which changes in redistributive policies affect increased differentiation in economic resources probably requires more detailed financial data than we were able to utilise in this study.

Concluding remarks

Our results give some indication that the associations between indicators of the economic position of households and health outcomes are responsive to change in labour-market and income inequality. Albeit this is not necessarily proof that the association between income and health is caused by differences in consumption potential, it does mean that a plausible explanation probably involves both the economic resources of households and labour-market mechanisms. It is perhaps premature to draw the strong conclusion that marked health inequalities by household income developed in Finland after the 1990s, but this may be the case according to our results, as well as to those on mortality reported by Tarkiainen et al. (2012). The socioeconomic changes that occurred in Finland during the period under study were not restricted to the distribution of market income and labour-market conditions, but also included a decline in the magnitude of income redistribution. It remains an open question whether the change in inequality related to health problems by income is, to some degree, attributable to changes in social policy, or whether it is mainly to do with market mechanisms.

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Tables

Table 1

The prevalence of sickness allowance and the average number of sickness-allowance days within three calendar years.

Period of sickness-allowance measurement	Entire sample		Those with allowance	
	Prevalence of any allowance	Average of 3-year total days	Average of 3-year total days	Median of 3-year total days
1990-1992	0.27	12.0	44.1	20
1997-1999	0.21	10.1	45.9	20
2005-2007	0.24	13.5	54.2	24

Table 2
Change in the association between household real income and sickness-allowance days as well as that between rank position on the income distribution and sickness allowance days across the three periods studied [a]: zero-inflated negative-binomial regression with piece-wise regression terms, adjusted for age, gender, higher education, occupational class and labour-market participation in the same period as the income data used.

	Main effect in 1987-1992		Change between 1987-1992 and 1994-1999 [b]		Change between 1994-1999 and 2002-2007 [b]	
	Estim. [c]	95% CI [d]	Estim.	95% CI	Estim.	95% CI
The effect on number of allowance days per 8,522 euros of real income						
Up to 15,000 euros	-0.16	-0.21 – -0.11	-0.24	-0.32 – -0.16	-0.05	-0.13 – 0.03
Between 15,000-23,000	-0.09	-0.13 – -0.05	-0.07	-0.12 – -0.01	-0.03	-0.09 – 0.03
Above 23,000 euros	0.01	-0.02 – 0.03	-0.02	-0.05 – 0.01	-0.01	-0.04 – 0.01
The effect on probability of allowance per 8,522 euros of real income						
Up to 23,000 euros	0.00	-0.03 – 0.03	0.23	0.20 – 0.27	-0.16	-0.19 – -0.12
Between 23,000-29,000	-0.04	-0.08 – 0.00	0.15	0.07 – 0.23	0.05	0.00 – 0.11
Above 29,000 euros	-0.10	-0.13 – -0.07	0.04	0.00 – 0.08	-0.06	-0.09 – -0.03
The effect on number of allowance days per 25 %-units of rank position						
Up to 18% quantile	-0.21	-0.29 – -0.12	-0.40	-0.54 – -0.26	-0.24	-0.39 – -0.10
Between 18-54% quant.	-0.06	-0.09 – -0.03	-0.07	-0.12 – -0.03	0.01	-0.04 – 0.05
Above 54% quantile	-0.01	-0.03 – 0.02	-0.04	-0.07 – 0.00	0.00	-0.03 – 0.04
The effect on probability of allowance 25 %-units of rank position						
Up to 52% quantile	0.00	-0.02 – 0.02	0.18	0.15 – 0.21	-0.07	-0.10 – -0.04
Between 52-80% quant.	-0.04	-0.06 – -0.01	0.06	0.02 – 0.10	-0.11	-0.15 – -0.07
Above 80% quantile	-0.50	-0.68 – -0.33	0.09	-0.16 – 0.34	-0.66	-0.91 – -0.40

[a] Sickness allowance in 1990-1992 predicted by household income in 1987-1989, sickness allowance in 1997-1999 by income in 1994-1996, and sickness allowance in 2005-2007 by income in 2002-2004.

[b] The data were pooled, and the change is modelled as an interaction of the income variable and the period, comparing the effect to that in the previous period.

[c] Model estimates for the effect of income (per 8,522 euros or 25-per-cent units) on sickness allowance within the given income range. The income data are continuous, and the slope of the regression coefficient is allowed to change in two pre-set points.

[d] 95-per-cent confidence intervals for the model estimates

Table 3

The decomposition of change[a] in the household-income-related inequality in sickness allowance days: the contributions of change in the effect of real income on sickness allowance (from negative binomial regression) and change in the distribution of real income.

Approximate contributions	Change accumulated[b]	
	from 1987-1992 to 1994-1999	from 1994-1999 to 2002-2007
Change in the effect of real income	0.004	-0.053
Change in average real income	0.001	-0.024
Change in relative income inequality (i.e. Gini coefficient)	-0.008	-0.009
Total for change in real-income difference[c]	-0.008	-0.033

[a] Decomposition method proposed by Wagstaff, van Doorslaer and Watanabe (2003).

[b] Contributions to change between the three periods studied were calculated as the sum of contributions from decomposition of change across one-year intervals, that is, change between 1987-1992 and 1988-1993, between 1988-1993 and 1989-1994, etc.

[c] Calculated as the sum of the contributions of change in average real income and change in relative income inequality.
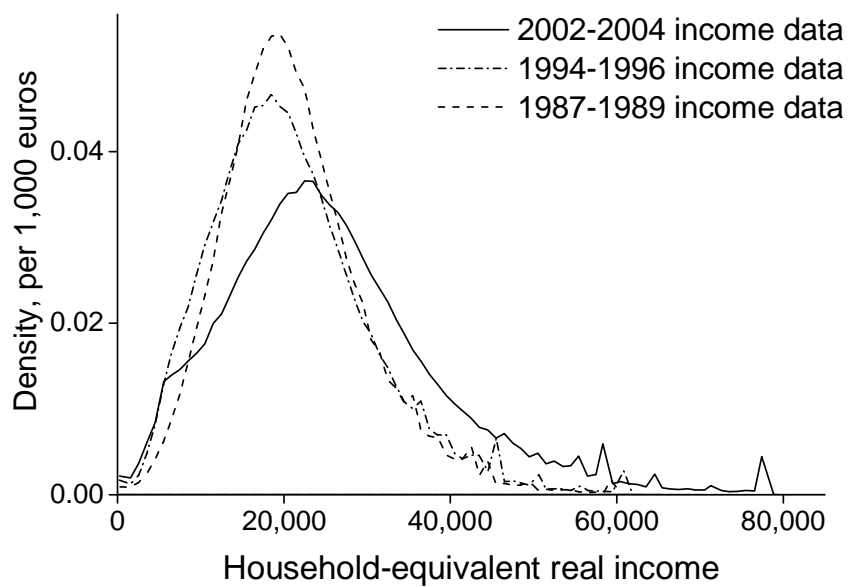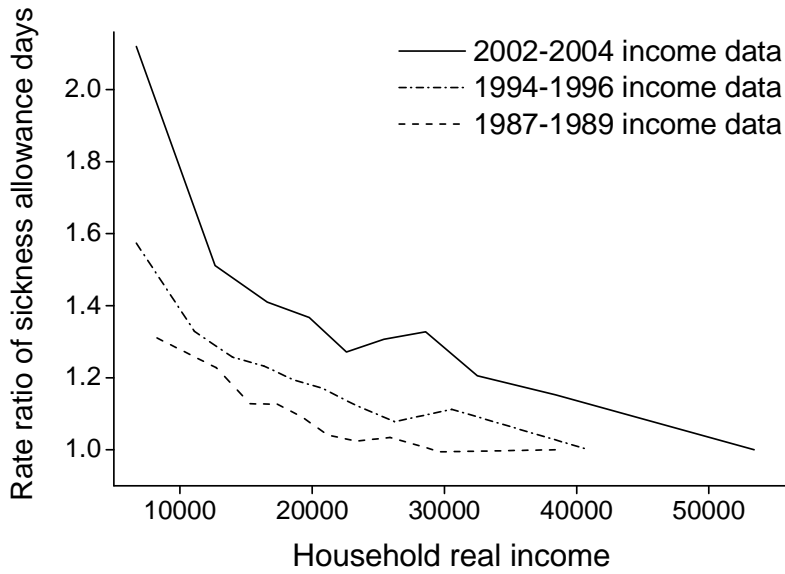
Figures with captions

Figure 1. The distribution of three-year average annual household-equivalent real income at 2002 price levels in the analysed sample in the three periods studied.
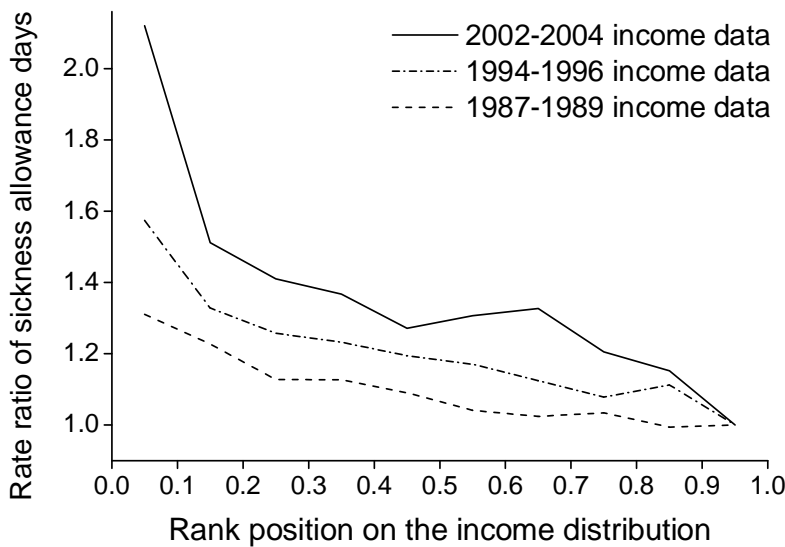
a)

b)

Figure 2. Sickness allowance days in years 1990-1992, 1997-1999 and 2005-2007 by tenths of household-equivalent taxable income: A) Top, plotted on real-income scale; B) Bottom, plotted on rank-position scale. Relative ratios from from negative-binomial regression adjusted for gender, age, higher education, occupational class and labour market participation during the period of income measurement.
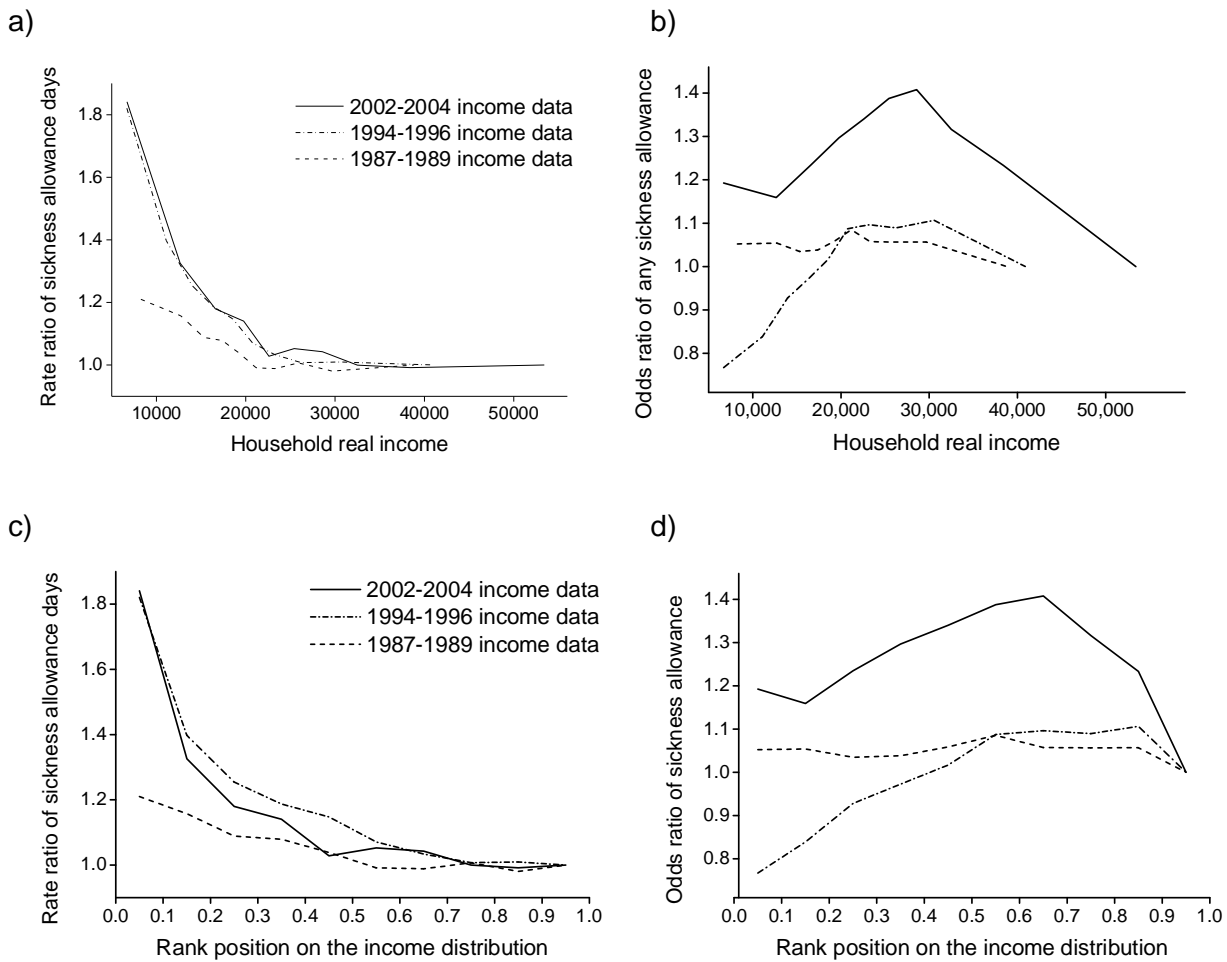
Figure 3. Sickness-allowance days in the years 1990-1992, 1997-1999 and 2005-2007 by tenths of household-equivalent taxable income: A) Top left, rate ratios for the number of allowance days from the count model plotted on real-income scale; B) Top right, odds ratios for non-zero allowances from the zero model plotted on real-income scale; C) Bottom left, rate ratios for the number of allowance days from the count model plotted on rank-position scale; D) Bottom right, odds ratios for non-zero allowances from the zero model plotted on rank-position scale. Zero-inflated negative-binomial regression adjusted for gender, age, higher education, occupational class and labour-market participation during the period of income measurement.