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Income mobility, dynamics and risk over the working life: income insurance from taxes and cash transfers in 2001–2008*

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*I am grateful to participants in the XXXII Summer Seminar for Finnish Economists and Matti Tuomala for useful comments on an earlier version of the paper. Anton Sobolev and Alexandr Peussa provided excellent research assistance. Funding from Kela, Dnro 56/26/2012, and the Academy of Finland, No. 268863 is gratefully acknowledged.

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Helsinki 2015

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ISBN 978–952–209-144-4 (pdf)
ISSN 1795–1801 (pdf)

Tiivistelmä

Tutkimuksessa tarkasteltiin työikäisen väestön, 20–59-vuotiaat vuonna 2000, tuloriskejä Tilastokeskuksesta hankitun laajan rekisteripohjaisen paneeliaineiston avulla. Vero- ja sosiaaliturvajärjestelmää tarkastellaan laajana sosiaalivakuutuksena ja vaikutusta riskiin mitataan tuotannontekijä-, brutto- ja käytettävissä olevien tulojen riskipreemioiden peräkkäisten erotusten avulla. Ennakkoon ennustetut (ex ante) toimeentuloriskit estimoidaan dynaamisen, eteenpäin katsovan mallin avulla. Logaritmimuotoinen malli kuvaa tuloliikkuvuutta suhteessa väestöryhmän vuosittaisiin keskituloihin. Estimoinnit perustuvat väestöositukseen, joka määräytyy ennusteperiodia edeltävän, syntymävuosikohortin, koulutusasteen ja sosioekonomisen aseman perusteella. Tulosten perusteella vero- ja tulonsiirtojärjestelmä pienentää merkittävästi kotitalouksien tulonvaihtelua ja tuloriskiä. Tästä näyttävät hyötyvän eniten ne ryhmät, joissa markkinatulojenriskit olivat suurimmat. Tulosten perusteella julkinen sektori saa aikaan merkittävää riskien (tulojen vaihtelun) uudelleenjakoa, joka täydentää tulonsiirtojen uudelleenjakoroolia. Välittömän verotuksen merkitys on huomattavasti tulonsiirtoja pienempi. Toteutuneihin arvoihin perustuvat (ex post) riskimittarit antoivat samansuuntaisia tuloksia kuin dynaamiseen malliin perustuvat mittarit. Kvalitatiivisesti arvioituna tulokset ovat myös pitkälle riippumattomia siitä, mitä riskinkaihtamisparametria laskelmissa käytetään.

Abstract

Register based Finnish panel data are used to examine income risk in the working age population. The paper considers the extent of risk reduction due to the tax-benefit system which is measured by successive differences between risk premia of factor, gross and disposable household income. Income risk has been estimated using a forward looking dynamic model for income mobility (deviations of log income from sub-population means) over a population strata by age, educational and socio-economic status. The population groups having relatively high labour/factor market risk seem to benefit most from the implicit income insurance provided by the public sector. The role of direct taxes is substantially lower than that of public cash transfers. The results based on the dynamic model are quite similar to those which are based on observed ex post values. The findings are qualitatively robust to a particular value of the degree of risk aversion assumed.

Keywords: risk-premium, social protection, redistribution, age
JEL classification: D31, D63, H24, H55

1. Introduction

One of the primary motivations for economic mobility studies is to measure the extent to which longer-term incomes are distributed more or less equally than incomes in a single year. Shorrocks (1978) has emphasised: “Mobility is regarded as the degree to which equalization occurs as the period is extended. This view captures the prime importance of mobility for economists.” According to the above view, the recent rise in income inequality would be of less importance if it had been accompanied with a rise in mobility.[1] This suggests that one should not measure annual, possibly transitory, change in inequality but the change measured over a longer (possibly life long) time span.

More generally, income mobility may be viewed as a coin with two sides (Fields & Ok 1999). On one hand, mobility may reduce long term inequality. On the other hand, mobility means fluctuations in individual incomes. The shift in assessment from annual to multi-period inequality means that future uncertainty about incomes must be accounted for in the evaluation (Creedy & Wilhelm 2002). Liquidity-constrained, forward-looking, risk-averse economic agents view rise in income fluctuations as an increase in income risk which lowers economic well-being in comparison with a steady flow of income. Therefore, interest in mobility also raises the issue of predictability, or uncertainty. Uncertainty related to income fluctuations is a key dimension of income mobility. A completely mobile society would mean complete economic insecurity. How to combine income mobility both as an equalizer of longer term income and as an income risk modifier into a well-defined social objective function (Creedy & Wilhelm 2002 and Fields 2010)?

Economic welfare and inequality have many dimensions, wages, earnings, income and final consumption. Analysing the dynamics of different income concepts together can add to our understanding of inequality dynamics. Variability in, say, wages, is mediated by implicit social insurance and multiple mechanisms of self-insurance. First, the household can adjust supply of working hours. Second, joint income of the household is affected by public policies, progressive taxation, social insurance and transfers. Third, informal contracts and voluntary gifts between

[1] In Finland annual income inequality rose significantly during the latter part of the 1990s (Riihelä, Sullström & Tuomala 2007, 2010). The period of major income equalization from mid 1960s to the mid 1990s has been reversed, taking the annual values of the Gini coefficient back to the levels of inequality found 40 years ago. In the Finnish case the phase of increasing income inequality has occurred much later than in the United States and in the United Kingdom, where annual income inequality has widened since early 1980s. In some other countries, such as Germany and Japan, the increase up to the early 1990s has been more modest, and Canada, France and Italy show no overall rise over the same period (Atkinson 2000).

households lend added insurance. Fourth, the household can draw on their accumulated assets to temporarily finance consumption. Furthest in line are partial adjustments in replacements of durable goods and semi-durables. The last mechanism is particularly relevant for poor households facing liquidity constraints and lacking access to credit market (Browning and Crossley 2009).

The present paper looks at the income risk and inequality of longer term certainty equivalent household incomes which have been controlled for the undesirable effects of income fluctuations over time. A number questions are addressed in the paper. What is the pattern of Finnish income risk? How does market income dynamics look like over the working life? How large risk premia does the income dynamics imply? How much income insurance does government provide?

The paper examines income dynamics over the working life and the role of the tax and transfer system as mechanism to smooth shocks to family market/factor income. In particular, the paper highlights that part of income smoothing which is provided by implicit social insurance rather than that affected by self-insurance (see also Carroll 1994, Carroll & Samwick 1998, and Hoynes & Luttner 2011), for labour market risk see also Blundell (2014).

The paper illustrates how income panel data can be used to shed light on these and similar questions. The ideal data are a long panel of individuals with large sample sizes. These are obtainable only by administrative data sources. The advantages are the accuracy of income information provided, relatively large data size and lack of attrition, other than due to emigration and death. The paper examines the dynamic income process in Finland, in 2001–2008 with large administrative panel data of Finnish working age population, 20–59 years old.

The method used is a simple and straight-forward one, and should be considered as a first step in the analysis. In this paper the average over a time span of eight years is used as a reference point to calculate the income risk, but it may have alternatives. A shorter time period might be preferable if the analyst targets for some specific, abrupt income shocks rather than for more general overall implicit insurance of the social protection and tax system that the public sector provides for.

Two alternative methods are used to estimate the income risk premia, offering an opportunity to compare the results. The first offers an ex post perspective and is based on actual sample values.

The second offers an ex ante perspective, and is based on a more sophisticated prediction of future incomes using an autoregressive model of income mobility around the annual values of sub-population means. The dynamics of the income process is dependent on how persistent the income shocks are and the variance of residual income shocks. Creedy & Wilhelm (2002) and Creedy, Halvorsen & Thoresen (2013) use the same model of taking (ex-ante) income uncertainty into account.

The present paper extends their analysis by estimating the model and calculating relative risk premia of factor, gross and disposable household income separately in a collection of population sub-groups. The classification of persons (relating to households) is based on pre-sample (at 2000) values of factors likely to affect labour market risk, the education level, socio-economic status of the sampled individual and five ten-year birth cohort classes. An effort has been made in separating income risk from the life-cycle effects on the income process by conditioning the estimators of relative risk premium on birth cohorts, obtained in 2000.

The Creedy, et al. (2013) model allows, under log-normality, for closed form expressions of predicted income and relative risk premia and use of the Atkinson index for a measure of inequality.[2] Their ex ante method is, however, based on assuming a correct form of the dynamic model for the income process and distributional assumptions which some may find restrictive whereas the first, ex post, method, is based calculating the corresponding sample equivalents for the theoretical risk premia, and the method is distribution free.

The dynamic model which is specified in terms of income mobility makes only a limited effort to distinguish between idiosyncratic and predictable income risk which play an important role in precautionary saving motives. [3] Deaton (1992) provides for an analysis that the ability of individuals to self-insure is sensitive to the properties of labour income process and income uncertainty. Blundell (2014) offers a recent and a more comprehensive analysis of individual

[2] Atkinson index is of the same functional form as the constant relative risk-averse utility function which is used to calculate relative risk premia in the current paper. One could have followed their approach in choosing the measure of inequality to be of the same functional form. Instead the Gini-coefficient (and the underlying implicit social objective function) is used here, a robust measure of inequality to give a measure of redistribution produced by Public sector in risk-adjusted and unadjusted household income.

[3] In the literature income risk (conditional variance) is divided into two components: risk to permanent income and risk to transitory income, see e.g. Blundell & Etheridge (2010). The permanent component of income is the persistent, stochastic trend of innovative income, while transitory innovation is defined as the deviation of income from the common trend. Income risk is here defined as unpredictability of income, not simply variability, and an income stream with high variance that is perfectly predictable would not be defined as risky. Therefore one needs to make assumptions about the information set on which individuals form predictions of their future income stream.

income process, using a general specification of log income with an error component model with a persistent process of income and a transitory income component.

The focus of the present paper is not to present very sophisticated and precise results for the income process. It covers some middle ground between Creedy et al. (2013) and substantially more general income dynamics in Blundell (2014). The present paper estimates both ex ante and ex post measures of average, longer term real income and risk premium in household income. Comparison of risk premia in factor, gross and disposable income gives a measure of how much income insurance the public sector provides through the tax-and-benefit system. The measures are dependent on how risk-averse individuals are and therefore the robustness of results is examined using several alternative, plausible values for the coefficient of relative risk aversion.

Controlling the average income for the risk premium due to income fluctuations allows comparisons of average income with the risk-adjusted, certainty equivalent income concept and corresponding measures of inequality.[4] The paper presents measures of how much redistribution does government achieve by public programs, cash benefits paid to households and household direct taxes (income taxes and employee social security contributions), using the successive differences between the Gini coefficients of factor, gross and disposable household income. Corresponding differences using between certainty equivalent income concepts give some useful information on redistribution of risk (an additional indicator of income insurance), and may be considered as adding to the literature.

Finally, the paper tests for the role of various categories of social benefits (ESSPROS 2012) in risk reduction by cash benefits paid to households where risk reduction is measured as the difference of the premia in factor and gross income.

The paper is organized as follows. Section 2 introduces the indicator of risk-aversion, the relative risk premium, and the dynamic model used to calculate the ex ante risk premium. The data are discussed in Section 3. The empirical results are presented in Section 4. Section 5 discusses the results.

[4] In the ex post case the average of actual sample values is used, whereas in the ex ante case one substitutes for averages of ex ante expected values, for details see Section 2.

2. Methods

The paper gives estimates of average, longer term real income and observed risk premium in household income. Controlling the average income for the risk premium due to income fluctuations allows for comparisons of average income with the risk-adjusted, certainty equivalent income concept and for assessment the amount of risk reduction due to implicit income insurance.

Assume that households have risk-averse preferences, and prefer a certain income to a random income flow having the same average income over the period. [5] Let the utility function for income y_t, be of the constant relative risk aversion (CRRA) form,

$$u(y) = y^{1-\gamma}/(1-\gamma), \qquad \text{if } \gamma \neq 1, \text{ and}$$

$$u(y) = \log y, \qquad \text{if } \gamma = 1. \tag{1}$$

Above $\gamma, \gamma > 0,$ is the coefficient of relative risk aversion. Suppose that income is distributed randomly with an expected (or average) value $\bar{y}$. The equivalent risk premium (ERP) is defined by the amount ψ such that

$$u(\bar{y} - \psi) = \mathrm{E}[u(y)]. \tag{2}$$

The equivalent risk premium is the monetary value which household would be willing to forgo from the certain level $\bar{y}$ and still be as well off as with the random income flow, y, Pratt (1964) and Arrow (1965).

For empirical studies a scale-less measure of equivalent risk premium is more useful, such as given by the relative equivalent risk premium (RERP),

[5] Neoclassical economic theory assumes that household utility is based on a flow of consumption not income. Therefore the risk premium should preferably be calculated in terms of consumption. The analysis follows most of the literature in substituting corresponding income variables for average and actual consumption, see Carroll (1994), Carroll & Samwick (1998), Creedy et al. (2013) and Hoynes & Luttner (2011). In effect one assumes that households consume exactly their disposable income, facing constraints due to incomplete capital and insurance markets constraints, or other constraints, e.g. precommited consumption, which rule out buffer-stock savings and prevent the household from "smoothing out" the consumption over time. The recent literature on social insurance emphasizes the liquidity effects in explaining why income shocks that are small relative to life-time wealth have large effects on consumption, Intuitively, benefits increase cash on hand and consumption for an agent who cannot smooth perfectly, see Chetty and Finkelstein (2012).

$$u(\bar{y}-\psi/\bar{y}) = \mathrm{E}[u(y)]. \tag{3}$$

Relative risk premium, $\psi/\bar{y}$ shows the proportion of mean income that is "wasted" in utility terms because of risk aversion and income variation.

In the case of constant relative risk aversion (CRRA):

$$\mathrm{RERP} = \psi/\bar{y} = 1 - \frac{\left[\mathrm{E}y^{1-\gamma}\right]^{1/(1-\gamma)}}{\bar{y}}, \qquad \text{if } \gamma \neq 1, \text{ and}$$

$$\mathrm{RERP} = \psi/\bar{y} = 1 - \frac{\exp(E\log X)}{\bar{y}}, \qquad \text{if } \gamma = 1. \tag{4}$$

The income process and uncertainty

For income mobility studies a convenient general specification of log income for individual *i*, is given by

$$\log y_{i,t} = \mu_t + \beta(\log y_{i,t-1} - \mu_{t-1}) + (1-\beta)\upsilon_i + \eta_{i,t}, \eta \propto N(0,\sigma_\eta^2),\ t = 2,\cdots,m, \tag{5}$$

where $\mu_t = (1/N)\sum_{i=1}^{N}\log y_{i,t}$, see Creedy et al. (2013).

This can be rewritten as the individual effects autoregressive model:

$$y^*_{i,t} = \beta y^*_{i,t-1} + (1-\beta)\upsilon_i + \eta_{i,t}, \eta \propto N(0,\sigma_\eta^2),$$

where $y^*_{i,t} = \log y_{i,t} - \mu_t$. The autoregressive parameter β, $0 < \beta \leq 1$, captures movements in income distribution that tend to persist for several years. A low degree of regression (high value of β) towards the mean implies low income mobility, but also a high predictability of future incomes, see Creedy et al. (2013). In the following we assume a stationary mobility process around the population means (μ_t), i.e. $0 < \beta < 1$.[6] The component $(1-\beta)\upsilon_i$ corresponds to an idiosyncratic fixed effect (relative to the mean). The error term η corresponds to a transitory

[6] However, this formulation of the model allows to consider the limit, $\beta \uparrow 1$.

income shock represented by a low-order MA-process. A low value of the variance σ_η^2 implies lower income mobility and higher predictability of future incomes relative to a high value of the variance.

Solving (5) by substitution gives:

$$\log y_{i,k} = \mu_k + \beta^{k-1}(\log y_{i,1} - \mu_1) + (1-\beta)\sum_{j=2}^{k}\beta^{k-j}\upsilon_i + \sum_{j=2}^{k}\beta^{k-j}\eta_{i,j}, k = 2,\cdots m, \quad (6)$$

and

$$E(\log y_{i,k} \mid y_{i,1}) = \mu_k + \beta^{k-1}(\log y_{i,1} - \mu_1) + (1-\beta^{k-1})\upsilon_i, \quad (7)$$

$$Var(\log y_{i,k} \mid y_{i,1}) = \sigma_\eta^2 \frac{1-\beta^{2(k-1)}}{1-\beta^2} + 2Cov(\eta_{i,t}, \eta_{i,t-1})\frac{\beta(1-\beta^{2(k-2)})}{1-\beta^2}, k = 2,\cdots,m, \quad (8)$$

assuming a MA(1) process for the transitory shock η.[7]

To calculate ex ante risk premia we approximate the cumulant generating function of the (conditional) income process with the first two cumulants (the approximation is exact in the case of a Gaussian error process, Creedy et al. 2013):

$$E(y_{i,k}^{1-\gamma} \mid y_{i,1}) = E(\exp((1-\gamma)\log y_{i,k}) \mid y_{i,1}) \approx \exp\left[(1-\gamma)E(\log y_{i,k}) \mid y_{i,1}) + \frac{1}{2}(1-\gamma)^2 Var(\log y_{i,k} \mid y_{i,1})\right],$$

if $\gamma \neq 1$, and substituting the limit value, if $\gamma = 1$,

$$\lim_{\gamma \to 1}\frac{1}{1-\gamma}E(y_{i,k}^{1-\gamma} \mid y_{i,1}) = E(\log y_{i,k} \mid y_{i,1}) = \mu_k + \beta^{k-1}(\log y_{i,1} - \mu_1) + (1-\beta^{k-1})\upsilon_i. \quad (9)$$

In the special case of forming expectations for one step forward (*k =2):* If $\gamma \neq 1$,

$$\left(E(y_{i,k}^{1-\gamma} \mid y_{i,1}) \big/ E(y_{i,k} \mid y_{i,1})^{1-\gamma}\right) = \exp\left[-\frac{1}{2}\gamma(1-\gamma)\ Var(\log y_{i,k} \mid y_{i,1})\right] \text{ by (7) and (8).}$$

[7] In formula (7) we do not invert the MA-process, instead we implicitly assume that the effect of MA-process on the expected value is unpredictable. In general transitory shocks to income are mean reverting and their effect does not last long. A comprehensive, recent overview of income dynamics is Blundell (2014).

Giving,

$$\mathrm{RERP}_{\mathrm{i,2}} = 1 - \exp\left[-\frac{1}{2}\gamma \;\; Var(\log y_{i,2} \mid y_{i,1}) \right] = 1 - \exp\left[-\frac{1}{2}\gamma \;\; \sigma_{\eta}^{2} \left(1 + \frac{2\beta\rho}{1-\beta^{2}} \right) \right],$$

ρ is the MA(1) autocorrelation parameter, $\gamma \neq 1.$ The formula also holds, for $\gamma = 1.$

In calculating the relative equivalent risk premium we compare the ex ante "utility" of a stochastic income stream

$\frac{1}{T(1-\gamma)}\sum_{k=2}^{T+1} E(y_{i,k}^{1-\gamma} \mid y_{i,1})$ with the "utility" of the mean income, $\left[\frac{1}{T(1-\gamma)}\sum_{k=2}^{T+1} E(y_{i,k} \mid y_{i,1}) \right]^{1-\gamma}$,

which are based on the expected (ex ante) values, suppressing income discounting.

This gives the relative equivalent risk premium (RERP):

$$\mathrm{RERP}_{\mathrm{i,T}} = \psi_{i,T} \,/\, \bar{y}_{i,T} = 1 - \frac{\left[\frac{1}{T}\sum_{k=2}^{T+1} E(y_{i,k}^{1-\gamma} \mid y_{i,1}) \right]^{1/(1-\gamma)}}{\bar{y}_{i,T}}, \text{ if } \gamma \neq 1, \text{ and}$$

$$\mathrm{RERP}_{\mathrm{i,T}} = \psi_{i,T} \,/\, \bar{y}_{i,T} = 1 - \frac{\exp\left((1/T)\sum_{k=2}^{T+1} E(\log y_{i,k} \mid y_{i,1}) \right)}{\bar{y}_{i,T}}, \text{ if } \gamma = 1, \qquad (10)$$

where $\bar{y}_{i,T} = \frac{1}{T}\sum_{k=2}^{T+1} E(y_{i,k} \mid y_{i,1})$.

With intermediate values of *T* the relative risk premium depends on the parameters of the model in a complicated way through the sums involving the terms given in (7) and (8). But assuming convergence: $\|\beta\| < 1$ and $\lim_{k\uparrow\infty} \mu_k = \bar{\mu}$, in the limit one obtains,

$$\lim_{k\uparrow\infty}\left[E(y_{i,k}^{1-\gamma}\mid y_{i,1})\Big/E(y_{i,k}\mid y_{i,1})^{1-\gamma}\right]=\exp\left[-\frac{1}{2}\gamma(1-\gamma)\left(\sigma_\eta^2\frac{1}{1-\beta^2}+2Cov(\eta_{i,t},\eta_{i,t-1})\frac{\beta}{1-\beta^2}\right)\right]$$

and

$$\mathrm{RERP}_{\mathrm{i},\infty}=\lim_{T\uparrow\infty}\psi_{i,T}/\bar{y}_{i,T}=1-\exp\left[-\frac{1}{2}\gamma\frac{\sigma_\eta^2(1+2\beta\rho)}{1-\beta^2}\right], \tag{11}$$

where ρ is the MA(1) autocorrelation parameter, if $\gamma\neq1.$ This also holds, for $\gamma=1.$

A high degree of regression towards the mean (lower value of $\beta<1$) and a high value of the residual variance σ_η^2 imply high income risk.

Below the ex ante risk premia (9) are compared with the ex post values calculated from the annual variation of income around the average income, at the individual level.[8] The ex-post version of utility with risk-averse preferences is a sum, $\frac{1}{T}\sum_{t=1}^{T}u(y_{i,t})$, suppressing income discounting. To be more exact, we use the corresponding sample moments:

$$1-\psi_T=\frac{\sum_i\left((1/T)\sum_{t=1}^{T}y_{it}^{1-\gamma}\right)^{1/(1-\gamma)}\Big/(1/T)\sum_{t=1}^{T}y_{it}}{N},\qquad \text{if } \gamma\neq1 \text{ and}$$

$$1-\psi_T=\frac{\sum_i\exp\left((1/T)\sum_{t=1}^{T}\log y_{it}\right)\Big/(1/T)\sum_{t=1}^{T}y_{it}}{N},\qquad \text{if } \gamma=1 \tag{12}$$

The empirical calculations are made separately for set of reasonable values of γ ($\gamma=1,\ldots,5,$), the coefficient of relative risk aversion.[9]

[8] Both the ex ante and ex-post risk premia are calculated over a stratum of the sample population. The classification of households is based on factors likely to affect labour market risk, ten-year birth cohort (5 classes) the education level (4 levels) and socio-economic status (4 classes) of the sampled individual, in total 80 classes.
[9] A conservative choice of ρ, the coefficient of relative risk aversion, $\gamma=1$, corresponds to the logarithmic utility function. In the paper we discuss mainly the results with $\gamma=3$, the same (plausible) baseline value as in Hoynes & Luttner (2011).

3. Data

The data are provided by Statistics Finland and are based on a ten percent population sample drawn from the resident population in 1995–2008.[10] Statistics Finland has collected for the sampled individuals data on employment, income, and some demographics. All the data are collected from linked administrative registers covering the whole Finnish population in 1995–2008. (Register) households are formed around each sampled individual by combining individual register data with register data of all individuals dwelling in the same housing units. This information is drawn from the register covering all housing units and their occupants in Finland.

The target population is individuals living in private households. Those living in institutions and individuals with top-coded income data (the one percent of those having the highest incomes) are excluded.[11] Top-coded income data and deletion of these observations mean that we cannot consider income risk within the top income group. Since there has been a considerable increase in the top income shares (Riihelä et al. 2010), which do not show up in our data, and their influence on the increasing values of inequality indices, we find that observed increase in annual income inequality has been in our data more moderate than in official statistics (Suoniemi 2012 and Official Statistics of Finland: Income distribution Statistics). Using the sample we form a nine year complete panel data of non-institutional population in 2000–2008 allowing dynamic income distribution analyses for population sub-groups with a reasonably large number of observations, and consisting of 252 371 working-age individuals (20–59 years of age in the year 2000) and corresponding to 2 271 339 observations.

The income data are collected from administrative registers covering the whole population and are more accurate than, say, data based on interviews, imputations and estimations as is commonly done in countries without access to register data, e.g. Jenkins (2011). Register based panel data have an additional advantage, as sample attrition is relatively low in comparison to survey data (see, Suoniemi 2012 and Jenkins, in Ch. 4, 2011).

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[10] Our total “target population” consists of 5 978 470 individuals which corresponds to all who have been resident sometimes in Finland in 1995–2008. The total sample size, including the top-coded observations, is 503 982 and 521 819 individuals in 1995 and 2008, respectively. Note that our population excludes individuals living in institutions.

[11] The underlying population data are confidential. To guarantee the confidentiality of the individuals included in our sample Statistics Finland has top-coded all observations in the top one percent of the income distribution in each sample year. These observations are left out of the analysis. Their omission may bias our measure of income risk downwards.

The income variables are obtained from the registers underlying the Finnish total statistics on income distribution (Statistics Finland 2006). They include the annual income of both the households and the sampled individuals. The variables include the amount of annual income and its composition from different income sources, e.g. labour and property income and also taking account of taxation and public income transfers.[12]

The variables in the data include household income with components describing gross income: labour income, including wage income (employed) and entrepreneurial income (self-employed), property income of households, and public cash transfers received and paid by households.[13] Factor income is composed of labour income, the sum of wage and entrepreneurial income, and property income. Disposable income is formed from the income components by summing factor income with cash transfers received and subtracting transfers paid by households. Economic conditions and income risk are examined using real household income which has been equivalised accounting for differences in household size and composition.[14] In calculations each household member is assumed to have access to an income level which is obtained by dividing total household income by an equivalence scale denoting the number of equivalent adults in the household. The (modified) OECD-equivalence scale gives weight one to the first member in the household, weight 0.5 to each additional member in the household over 13 and 0.3 to those under 13 years of age.

[12] In the absence of interview data, the concepts of our income data do not meet fully the national and international recommendations for income (Canberra Group 2001). For example we do not have access to some sources of property income that are either tax-exempt (imputed net rent from owner-occupied housing) or are currently taxed at the source, e.g. interests from bank deposits. The same applies to private transfers among households. Taxes paid and cash transfers from public sector are covered completely, transfers even in the case when they are tax-exempt.

[13] The income sources that define disposable income are: property income, labour (earned) income which includes both wage income (employed) and entrepreneurial (self-employed) income, cash transfers received and income transfers paid. Property income includes rents, dividends, taxable interest payments, private pensions and capital gains. Entrepreneurial income accrues to self-employed from agriculture, forestry and firms. Wage income consists of money wages, salaries, value of managerial stock options and compensations in kind, deducting work expenses related to these earnings. Cash transfers received include, housing benefits and child benefits, unemployment and welfare assistance, unemployment and sick insurance and national and occupational old age, disability and unemployment pensions. Income transfers paid include direct taxes and social security contributions paid by the household members. The sum of property and labour income corresponds to factor income. Adding cash transfers gives gross income. Disposable income is obtained by deducting income transfers paid.

[14] Cost-of-living-index data (Statistics Finland) have been used to transform nominal annual values to real values, in 2008 prices.

Table 1 ESSPROS classification of social transfers by function

1. *Sickness/Health care* Income maintenance and support in cash in connection with physical or mental illness, excluding disability. Health care intended to maintain, restore or improve the health of the people protected irrespective of the origin of the disorder. 2. *Disability* Income maintenance and support in cash or kind (except health care) in connection with the inability of physically or mentally disabled people to engage in economic and social activities. 3. *Old age* Income maintenance and support in cash or kind (except health care) in connection with old age. 4. *Survivors* Income maintenance and support in cash or kind in connection with the death of a family member. 5. *Family/children* Support in cash or kind (except health care) in connection with the costs of pregnancy, childbirth and adoption, bringing up children and caring for other family members. 6. *Unemployment* Income maintenance and support in cash or kind in connection with unemployment. 7. *Housing* Help towards the cost of housing. 8. *Social exclusion not elsewhere classified* Benefits in cash or kind (except health care) specifically intended to combat social exclusion where they are not covered by one of the other functions.

Our data include a classification of public cash transfers by the European System of Integrated Social Protection Statistics (ESSPROS 2012) which is utilised in the analysis.[15] In the European

[15] Social protection encompasses all interventions from public or private bodies intended to relieve households and individuals of the burden of a defined set of risks or needs, provided that there is neither a simultaneous reciprocal nor an individual arrangement involved. The European system of integrated social protection statistics (ESSPROS) is a common framework developed in the late 1970's by Eurostat and the European Union Member States providing a coherent comparison between European countries of social benefits to households. ESSPROS is built on the concept of social protection, or the coverage of precisely defined risks and needs; it records the receipts and the expenditure of the organizations or schemes involved in social protection interventions. Receipts of social protection schemes are classified by type or by origin: the *type* gives the nature of, or the reason for a payment, and the *origin* specifies the institutional sector from which the payment is received.

System of Integrated Social Protection Statistics social benefits are classified by function and by type. The type of benefit refers to the form in which the protection is provided, benefits in cash or, benefits in kind i.e. public provision of goods and services. The function of a social benefit refers to the primary purpose for which social protection is provided. The classification by function provides a useful classification of public transfers according to both the income risks and social protection which Government is covering and providing for. Eight functions of social protection are distinguished in the ESSPROS (Table 1).

Finnish Study Grant and a Housing Supplement cover for student funding and are not included in the ESSPROS categories but form an integral part of Finnish cash benefit system. In the paper the student benefits and Sickness Allowance benefits are used as additional categories of social cash benefits.[16] They are both provided by Kela (Social Insurance Institution), and are funded by the State and statutory contributions from employers, and employees and self-employed.

The classification of socio-economic groups and education level divides the population into groups according to their social and economic characteristics.[17] To guarantee the confidentiality of the individuals included in our sample Statistics Finland has provided us with a classification of socio-economic groups and education at a relatively coarse level where some original classes have been pooled together. For details, see the Appendix.

[16] Sickness Allowance benefits, provided by National Health insurance compensate employees for part of their loss of income

[17] Finland's Classification of Socio-economic Groups 1989 is based on the statistical recommendations issued by the UN for the 1990 Population Censuses although it does not fully comply with them. Socio-economic status is formed of several different classification criteria because there is no single criterion that would embody all the factors influencing the status of the person.

4. Results

Estimating the income process

The evidence of heterogeneity in the dynamics of labour income by birth cohort (age), skill level, and their interaction motivates the following analysis. Accounting for heterogeneity is particularly important as one considers not only income mobility but also income uncertainty and the insurance from taxes, transfers and the family.[18]

Income is dependent on age and can be represented on average as a hump-shaped profile over the life-cycle. Also, education will influence the overall income level as well as the life-cycle profile with people with low education usually having a flatter income profile, while people with higher education start earning income later but afterwards have a more rapidly growing income profile. For current purposes a convenient general specification of log income for individual *i* of birth cohort *c* and education level *e*, $i \in A_{c.e}, \sum_{c,e} A_{c.e} = \Omega,$ is given by

$$\log y_{i,t}^{c,e} = \mu_t^{c,e} + \beta^{c,e}(\log y_{i,t-1}^{c,e} - \mu_{t-1}^{c,e}) + (1-\beta^{c,e})\upsilon_i^{c,e} + \eta_{i,t}^{c,e}, \eta_{i,t}^{c,e} \propto N(0, \sigma_\eta^2(c,e)) \quad (5)$$

where $\mu_t^{c,e} = (1/N)\sum_{i=1}^{N} \log y_{i,t}$ (with summation over all $i \in A_{c.e}$).

Above the analysis by Creedy et al. (2013) is extended to allow variances $\sigma_\eta^2(c,e)$ and persistence of shocks $\beta^{c,e}$ to vary with education for each (ten year) birth cohort. Influenced by Creedy et al. (2013) the individual income process is modelled relative to the average over the educational group for each ten year birth cohort.[19] This allows for common deterministic or stochastic age trends for educational groups and birth cohorts but rules out idiosyncratic trends, for a more comprehensive analysis of individual income process, see Blundell (2014).[20]

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[18] In contrast Creedy et al. (2013) focus on general features in income risk and temporal change in overall income mobility to motivate their use no other explanatory variables.
[19] To avoid messy notation we will revert to earlier convention and drop the indices for birth year cohort and education level unless absolute necessary.
[20] Some examples of idiosyncratic innovations are associated with job mobility, long-term unemployment, health shocks, and promotions. Transitory shocks to individual labour income typically include overtime labour supply, piece-rate compensation, bonuses, etc.; in general, such shocks are mean reverting and their effect does not last long.

Blundell's general specification of log income utilises the error component model with a persistent process of income shocks and transitory income component.[21]

With the autoregressive form and the individual effect υ_i included, it follows that since $y_{i,t}$ is dependent on υ_i, $y_{i,t-1}$ also depends on υ_i (if $\beta \neq 1$), which means that standard estimation (OLS, fixed and random effects) renders biased estimates. The literature on dynamic panel data models offers a number of methods for addressing this, see e.g. Arellano and Bond (1991) and Blundell and Bond (1998).

In dynamic panel data models where the autoregressive parameter is moderately large and the number of time series observations is moderately small, the widely used linear generalised method of moments (GMM) estimator obtained after first differencing has been found to have large finite sample bias and poor precision in simulation studies (see Alonso-Borrego and Arellano, 1999). Blundell and Bond (1998) propose a two-step system GMM estimator, based on moment conditions for errors in level and in first differences. They utilize moment restrictions that justify the use of GMM estimator that uses lagged differences $y_{i,t}$ as instruments for equations in levels (proposed also by Arellano and Bover 1995), in addition to lagged levels of $y_{i,t}$ as instruments for equations in first differences. This extended GMM estimator offers substantial efficiency gains and the gain is larger for higher value of the autoregressive parameter and as the number of time observation gets smaller (if $\beta \neq 1$). The **xtpdp** command of STATA is used for these estimations and a MA-error process in allowed for in the estimations.

The parameters of the dynamic model (5), the relative equivalent risk premium (8), i.e. the income risk arising from the estimated annual variation of income around the eight year (2001–2008) averages of ex ante (at 2000) expected values of annual income are estimated over a stratum of the sample population. [22] The classification of persons (relating to households) is

[21] In a sense our model covers some middle ground between Creedy et al.(2013) and substantially more general income dynamics in Blundell (2014). The focus of the present paper is not to present very sophisticated and precise results for the income process. For example, having available a smaller sample size than Blundell (2014) confines the estimations to ten year birth cohorts, pooling together some heterogeneity which may show up in the residual dynamics and/or in heteroscedasticity.
[22] The income variables have to take positive values. Therefore they have been bottom-coded with 1200 € in annual real equivalised income (2008 prices). This has little influence on the measurements which use disposable income. However factor income is frequently observed with zero values, which may have some influence on the specific values of the dynamic parameters one observes. Therefore the analysis is confined to the working age population.

based on pre-sample (at 2000) values of factors likely to affect labour market risk, the ten-year birth cohort (5 classes) the education level (4 levels) and socio-economic status (4 classes) of the sampled individual, in total 80 population sub-groups.

[Table 1]

Table 1 reports a summary of the estimation results for household equivalent factor, gross and disposable income.[23] In the estimations we have to allow for a possibility of a MA(2) error term.[24] The results for equivalent factor income show that in 32 out of 80 cases the corresponding LM-test for second order autocorrelation, note also (8), is significant at the 5 per cent level and the corresponding figures are 56 and 58 for gross and disposable income, respectively.

Transitory shocks to equivalent factor income have substantially higher variances (in the mean, they are four-fold) than those of the other income concepts. This suggests a marked degree of implicit income protection of the shocks to market income by Public sector (Table 1).

The sample equivalents of fixed effects have low variance relative to the variance of the transitory components of income. The latter are about 10 times the former which corresponds to about three-fold increase in standard deviations.[25] First, our fixed effects are measured as deviations from narrowly defined sub-group means. Second, the fixed effects in (5) are defined in the autoregressive form of the equation (having a lagged value of the dependent variable on the R.H.S.) with the level of fixed effects $(1-\beta)\upsilon_i$. This deflates the variance of the fixed effects by a factor, $(1-\beta)^2$.

One observes a relatively high persistence (the value of β) in log-income process relative to the sub-group averages. The values are higher than in Creedy et al. (2013) where the persistence is measured relative to the average of the whole population. The persistence in equivalent factor

[23] Tables A1-A3, in the Appendix contain the estimation results for each population sub-groups with accompanying test statistics.
[24] In fact, starting with a ‘common factor’ form, as in Blundell (2014) and writing the equation in terms of deviations from group means with a shared persistent component introduces an additional lag into the MA process (Details available on request). On the other hand, having a smaller sample than Blundell (2014) and use of ten year birth cohorts, may pool together heterogeneity which shows up in a higher order autocorrelation.
[25] Naturally the fixed effects are not estimated consistently, but their variance is. Similarly, one expects that the mean risk premia over the group which are estimated below conditional on the fixed effects are estimated consistently.

income is generally higher than in gross and disposable income (Table 1). One can conclude that the tax-transfer system reduces both the amplitude and persistence of shocks to factor income.

The stationarity assumption ($|\beta| < 1$) is in question in a few population sub-groups. In the estimations the 5 per cent confidence interval of the coefficient β exceeds the value one, in 9 out of 80 cases of equivalent factor income, and the corresponding count is 5 in both gross and disposable income. In short panels, there is a general tendency to scale the estimated coefficient β towards zero, in particular if the standard first-differenced GMM estimator is used. The bias increases with the relative variance of fixed effects and transitory error and as $\beta \to 1$ (Blundell & Bond 1998).[26]

However, in our case the variance ratio is quite low. In addition, the choice of instruments as in Blundell and Bond should mitigate the problem. The necessary condition in Blundell and Bond is $\mathrm{E}(\upsilon_i \eta_{i,1}) = 0$, i.e. the deviations of the initial conditions are uncorrelated with the level of the initial condition υ_i. This condition is satisfied in the fully stationary model, and any entry period 'disequilibrium' from υ_i which is randomly distributed across agents will preserve the condition (Blundell and Bond 1998).

Nevertheless, at the 1 per cent level the Sargan test rejects the over-identifying restrictions in 12, 8 and 7 out of 80 cases in equivalent factor, gross and disposable income, respectively. The rejection may indicate some violation of the initial condition, e.g. with the magnitude of the subsequent shocks (measured on a log-scale) depending on the initial position in the income distribution. A substantial part of the rejections of the Sargan test (3, 2 and 2 cases in equivalent factor, gross and disposable income, respectively) occur in the socio-economic classes in the oldest age group (50–59 years old in 2000) and with the highest education level (Tables A1-A3, in the Appendix).

[Table 2]

[26] Preliminary estimations indicated that shorter, e.g. 4 (5 with pre sample values) year, panels which allows for examination of temporal change in the income mobility processes as in Rantala & Suoniemi (2010) and Suoniemi (2012) would not allow for reliable estimation of the dynamic model, especially so in the presence of MA(2) errors.

Risk premium, social benefits and taxation

Next the (relative) ex ante risk premia are estimated at the individual level for equivalent factor, gross and disposable income using the estimated parameters of the dynamic model, see (10). Table 2 reports the sample statistics of mean values of expected logarithmic income and estimated risk premia in 2001–2008. The expected (log) income values reproduce the sample variability quite closely. This is due to using in their calculation individual level estimates of fixed effects.[27] By construction the estimated ex ante risk premia increase with the degree of relative risk aversion. In the following, we focus on the results with $\rho = 3,$ the same baseline value as in Hoynes & Luttner (2011).[28] With this particular risk aversion parameter the average risk premia are 49, 15 and 12 percent of the means of factor, gross and disposable income, respectively. The corresponding figures for the ex post risk premia are considerably smaller, 22, 8 and 7 percent of income. The latter, the income risk arising from the annual variation of income around the eight year average income, are estimated at the population level as the average of individual risk premia over the same stratum of the sample population as the parameters of the dynamic model, see (12). [29]

[Table 3]

Table 3 reports the sample statistics of mean ex ante risk premia in the observation cells which relate to this stratum of the sample population.[30] There is substantial (labour) market risk in Finland, after allowing for self-insurance by adjusting individual supply of working hours and family labour supply. In the working-age population, especially young adults and the oldest age cohort face more factor income risk relative to others (Table A4, Appendix). Preliminary examination of the data indicated that relative risk premia in factor income decrease as the level of education increases and they are substantially lower for those whose socio-economic status is a worker or an employee than for those not working, in the first year of the panel, as expected.

[27] Naturally the fixed effects are not estimated consistently at the individual level, but their variance is. In addition since the dynamic model is formulated for deviations from the annual sub-group means the annual averages are preserved.

[28] Results based on alternative values, $\rho = 1,\ldots,5,$ are in a great majority of cases qualitatively similar to these and are available on request.

[29] The ten-year birth cohort (5 classes) the education level (4 levels) and socio-economic status (4 classes) of the sampled individual, in total 80 population sub-groups.

[30] The relative risk premia of factor, gross and disposable income in all population subgroups in 2001–2008, with the risk aversion parameter $\rho = 3,$ are shown in Tables A4 and A5 in the Appendix.

The difference of risk premia in factor income and disposable income gives information on the extent of risk reduction produced by the public sector across the population sub-groups. The difference can be partitioned into first, the difference between factor and gross incomes and second, the difference between gross and disposable incomes. The first one informs us about the risk reduction due to the (cash) benefit system and the second one relates to (direct) tax system.[31] The tax system has the correct, risk reducing effect that one would expect from a progressive tax system that operates as an economy-wide automatic stabilizer, but it has far less influence on the income risk than the benefit system.

[Table 4]

Table 4 presents the results from an additive model of risk reduction using as explanatory variables the main factors of the corresponding table by population groups, i.e. education, age/birth year and socio-economic status. Here a simple weighted regression is used with weights proportional to the number of individual observations in the population cell. The weighting reflects the fact that the precision (in terms of sample variance) in estimating the risk premia is expected to be roughly proportional to the number of observations in the cell. [32] The results give a concise description of the data. Those approaching retirement age, 50–59 years old, seem to gain most from the risk reduction. In addition, there is a clear downward gradient with respect to the education level. Self-employed and white collar employees benefit less and those with low education level and not employed seem to benefit most from the implicit income insurance. The latter represent those population groups having relatively high (labour) market risk (Table A1).

The results for ex ante risk reduction which are based on our dynamic model are remarkably similar to those which are based on observed ex post values. The risk profile of disposable income is quite flat with the exception of those who are either the youngest, 20–29 years old, self-employed or are not employed in 2000. These groups, which have higher risk, have in many cases lower participation and coverage rates in social insurance programs than employees.

[31] In Finland most social benefits are taxable. The notable exceptions to this rule are General Housing Allowance and Housing Allowance for Pensioners (in the Housing benefits category) and Living allowance (in the Social exclusion category). Therefore order of reception of cash benefits before payment of the taxes makes more sense in Finland than in countries with tax benefit systems where most benefits are not taxable.

[32] In the case of ex post risk, this holds since in estimating the premium as the mean over the cell observations, the variance of the estimator is proportional to the number of observations in the cell. In the case of ex ante risk, one should in principle allow also for sample variability of the estimated parameters of the dynamic model.

[Figure 1]

Next one looks into the redistribution of income and ex ante income risk within age/birth year cohorts.[33] An established measure indicating how much redistribution does government achieve by public programs, cash benefits paid to households and households' direct taxes (income taxes and employee social security contributions), can be calculated as the successive differences between the Gini coefficients of equivalised factor income (before taxes and transfers), gross income (before taxes) and disposable income. Figure 1 shows the Gini-coefficients and Figure 2 shows these differences in risk-adjusted, $\rho = 3,$ certainty equivalent mean household income and in unadjusted (eight year) average equivalised income by ten year age groups. [34]

[Figure 2]

Observed "redistribution within age groups" is considerably larger in risk-adjusted units of income.[35] The public sector operates a considerable income insurance mechanism, over and above the redistribution of average (eight year) income. The age profiles of (within group) income redistribution have a U-shape with income redistribution effect rising up both at the start of the working life and at the near-retirement age group (Figure 2). The redistribution effects which accounts for income risk is substantially larger for those approaching retirement.

Although risk adjusted factor income have much higher Gini-coefficients than the unadjusted mean income figures, the substantial scale of income insurance by the public redistribution flattens out the age profile of the Ginis of disposable income.[36] Remarkably, the remaining inequality in disposable income is not dependent whether one looks at the risk-adjusted or unadjusted disposable income, and shows an upward gradient with respect to age (Figure 1).

[33] Each age-group is treated differently in an effort to separate income fluctuations corresponding to income risk from the life-cycle pattern in income. This could motivate using even shorter short time-spans than 10 years as here.
[34] In the ex ante case, one uses the individual level averages of (ex ante) expected values, for details see Section 2.
[35] The Gini coefficients are calculated separately for each ten year age group. Therefore they miss redistribution between age groups, and ignore the question, how redistribution is financed.
[36] Naturally, the magnitude of the difference is largely governed by the value of risk aversion parameter used, with smaller values giving substantially smaller differences.

Risk reduction, comparing the categories of social benefits

Finally, we examine how successful the various categories of social benefits are in risk reduction by examining their partial correlations with the extent of risk reduction, i.e. difference of risk premia of factor and gross income. The observed variation in differences across population sub-groups is explained by adding to the regression model the gross income shares of the cash benefits, and testing for their inclusion in a simple descriptive model of risk reduction.[37]

[Table 5]

Typical results for the ESSPROS categories of social benefits are presented in Table 5.[38] The first thing to note is that in this regression, as in most others, only three categories of social benefits enter the equation significantly and with a correct, positive sign. These categories are Sickness/Health care, Old age and Unemployment benefits. In contrast, Disability and Family/Children benefits are negatively (and with significant coefficients) related to income risk reduction. It appears that at this level of aggregation of the data only a few income shares of cash benefits (in the population sub-groups considered) are positively related to the general level of risk reduction produced by the public sector.

It is a surprise to find out that the categories, Disability benefits and Family/Children benefits, enter the equation with wrong sign. Family/Children benefits, however, loses significance when post sample values are used to calculate the premium difference. What lies behind this? First, the different categories may serve functions that overlap in the type of income risk, they cover for. If this is the case, then some categories might well lose their significance. By definition the functions of the ESSPROS categories of social benefits do not overly overlap but the categories lump together many different types of cash transfers. They range from social insurance benefits with some restricted eligibility and duration which insure for loss of labour income to various forms of social assistance covering basic needs and bringing incomes to a guaranteed minimum

[37] Sample statistics for ESSPROS categories of social benefits are presented in Table A6, in the Appendix.

[38] Table 5 shows the results where the variables controlling for level of education have been included to show that the results are robust to their inclusion and results do not change, qualitatively. Controlling for socio-economic status does not affect the qualitative results regarding the significant variables, either. However, if the controls for the age-groups are entered, some coefficients become unstable. It may well be that some ESSPROS categories of social benefit functions are covering such special income risks which are closely related to person's age rather than hers/his education level or socio-economic status at this level of aggregation.

level with few other restrictions than a test of means. For example, the data include an additional variable, Sickness insurance, which provides insurance for loss of labour income. [39] This variable enters the equation underlying Table 5 with a significant positive coefficient while preserving the significance and sign of the Sickness/Health care variable, although the added variable caters for similar functions that the existing variable with some overlap also with the variable, Disability.

On the other hand, the inability to find significance may involve the aggregation of data in population sub-groups and in the temporal dimension. The time frequency used to calculate income risk and the corresponding premia may be crucial to the analysis. Here an eight year time period is used which may lose the effects of sudden but long-lasting income shocks. Disability and a birth of a child have both relatively long-lasting consequences for earnings ability. Therefore, the income shock and risk involved may be lost in the above estimations and the benefits may show up as a steady income transfer covering for a permanent (up to 8 years) loss of income rather than as an insurance, the above analysis is looking for.[40]

Further, finding statistical significance may suffer from that those in working-age are not the primary group targeted by some of these benefits, e.g. Survivors' benefits, and the positive effects of risk reduction are missed here, after controlling for all other benefits. In addition, Survivors' and Student benefits are not among major benefits; their share in gross income is under a half percent (Table 4). These benefits are received by a small part of the population and accrue to somewhat special population groups with presumably little factor income to compensate for.

Clearly, alternative ways of looking at the data, which are tailored in the temporal dimension and targeted to the appropriate segment of population with the benefit category in consideration, are needed for determining their contribution to income risk reduction.

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[39] Sickness insurance refers to compensations from a mandatory insurance scheme which protects individuals from earnings losses due to sickness and injury with earnings related replacement rates.

[40] Our choice of the population strata is may not helpful either since only some individuals in the population sub-groups are affected by the loss of income in connection with Disability and Family/Children benefits and many more among those benefitting are experiencing a steady flow of these benefits.

5. Discussion

Neoclassical welfare analysis which underlies most income distribution studies and public economics is firmly anchored to static models under certainty. Income mobility is frequently seen to represent a positive element in society whereas income risk imposes costs to risk-averse households with liquidity constraints. How to introduce income mobility as an equalizer of longer term income into the social objective function, while simultaneously recognising the role of risk, is a demanding task (Fields 2010). The shift in perspective from annual to longer period inequality entails that future uncertainty about incomes is accounted for. This paper examined to what extent one can equate income mobility with income risk. Creedy et al. (2013) present a framework which comes nearest to the one used in the current paper.

In income mobility studies the emphasis has been on the equalization of longer term inequality of mean income. To obtain reasonable estimates of risk premia, level of education, socio-economic status and age/birth year, factors likely to affect variability of income, are controlled for in the estimations. A large number of observations available in the data facilitates estimation of a autoregressive model of dynamic income process using deviations from sub-group means. The paper estimated relative risk premia to adjust individual average incomes for risk aversion and looked at the inequality of longer term certainty equivalent (mean) incomes which have been controlled for the undesirable effects of income fluctuations over time.

Naturally the results depend on the conditioning factors. Including more conditioning factors one tends to get more variation in the estimators of income risk. In the extreme case one would equate all income variation at the individual level with income risk. But all income variation at the individual level is not to be equated with unpredictable income risk. [41] The method used is a simple and straight-forward one, and next step in the analysis would be to consider robustness of results to the chosen set of conditioning factors used to estimate income risk. Here the results for ex ante risk reduction which are based on a dynamic model were remarkably similar to those which were based on observed ex post values.

In the current paper an effort has been made in separating income risk from the life-cycle effects on the income process by conditioning the estimators of relative risk premium on age. This is an

[41] Creedy et al. (2011) estimate dynamic income process and income risk using three underlying parameters. The current paper utilises substantially more parameters to control for birth year cohort, education level and socio-economic status in the pre sample period.

important aspect and life-cycle effects should be given a more thoughtful treatment in studies of income risk. In the future, greater reliance on potentially volatile income sources in old age and increasing longevity makes it more likely that older people may observe substantial shocks in their income.

The results look reasonable. There has been substantial (labour) market risk in Finland in 2001–2008, after allowing for self-insurance by adjusting individual supply of working hours and family labour supply. In the working-age population, relative risk premia in factor income decrease as the level of education increases and they are substantially lower for those whose socio-economic status was a worker or an employee than for those not working, as expected.

Similarly by comparing the risk premia of factor and disposable income one observes that the tax-transfer system reduces both the amplitude and persistence of shocks to factor income. The comparison clearly shows the (utility) scale of income insurance by the redistribution programs consisting of social benefits and progressive taxation, and factor income risk of this magnitude is beyond those households' means which occupy the most risk-prone and low-income groups.[42]

The tax system has the correct, risk reducing effect that one would expect from a progressive tax system that operates as an economy-wide automatic stabilizer, but it has far less influence on the income risk than the benefit system. Interestingly, a decrease in the Reynolds-Smolensky progressivity of taxation measure has been found Finland in the 2000's by decomposing the change across income deciles (Riihelä, Sullström & Suoniemi 2008). The decrease has been affected most by changes at the high end of the income distribution.[43]

The results for ex ante risk reduction which are based on our dynamic model are quite similar to those which are based on observed ex post values. In particular, taxes and transfers lead to an attenuation of the variances of transitory shocks and risk premium in disposable income for the low skilled. Self-employed and white collar employees benefit less and those with low

[42] Already an early and influential study by Shorrocks (1980) reported that comparison of family income with male earnings showed limited opportunities to self-insurance by family labour supply.

[43] The main factor that has driven up the top income shares in Finland since the mid 1990s is in a sudden increase in the share of capital income, and the 1993 tax reform is seen as a key factor responsible for this trend as top incomes have become more and more composed of dividend income (Riihelä et al. 2008). The 1993 Finnish tax reform, introducing the Nordic dual income tax model, created strong incentives to shift earned income to capital income for those in the highest marginal tax brackets (Pirttilä and Selin 2011). The dual income tax treats capital and earned income differently. In those income groups facing high marginal tax rates in earned income, capital income is taxed using much lower rate. A strong correlation between the level of before-tax income and share of capital income offers an explanation for the decrease in progressivity of taxation.

education level and not employed seem to benefit most from the implicit income insurance. These groups, which have higher risk, have in many cases lower participation and coverage rates in social insurance programs than employees.

The paper presented estimates on the redistribution effect using differences between Gini coefficients of factor and disposable household income. Risk-adjusted¸ certainty equivalent income concepts were used to get useful information on redistribution of risk, an additional indicator of income insurance, and may be considered as adding to the literature. The public sector operates a considerable income insurance mechanism, over and above the redistribution of average (eight year) income. In the Finnish working-age population those with lower factor income are at the same time exposed to more risk in factor income. Remarkably, the remaining inequality in disposable income as measured by the within the age-group Gini coefficients is not dependent whether one looks at the risk-adjusted or unadjusted disposable income.[44]

Stiglitz and Youn (2005) have studied an ‘integrated lifetime insurance pension program’. Under the integrated lifetime insurance pension an individual can use savings to provide cover for all income risks, e.g. unemployment, health and disability. They show that so long as the risks are not perfectly correlated then it pays to integrate all insurance programs rather than to have separate insurance programs covering each risk. The gain of joint integration—having a common pool from which to draw upon—gets larger as the correlation gets smaller.

The paper examined, how successful the separate ESSPROS categories of social benefits are in risk reduction by examining their partial correlations with the extent of risk reduction, i.e. difference of risk premia of factor and gross income. The results were mixed: only three categories of social benefits enter the equation significantly and with a correct, positive sign. These categories are Sickness/Health care, Old age and Unemployment benefits. Therefore, it appears that at this level of aggregation of the data only a few income shares of cash benefits (in the population sub-groups considered) are positively related to the general level of risk reduction produced by the public sector.

Seemingly, it appears that at this level of aggregation the ESSPROS categories of social benefits (in the population sub-groups considered) cannot identify specific, separate income risks. If this

[44] The values of the corresponding Gini coefficients of certainty equivalent household factor income depend on the degree of risk aversion assumed. However, the results are in a great majority of cases qualitatively similar to these and are available on request.

is the case then some categories might well lose their significance. Although ESSPROS categories of social benefits by construction serve functions that do not overly overlap, the categories lump together many different types of cash transfers. They range from social insurance benefits with some restricted eligibility and duration which insure for loss of labour income to various forms of social assistance covering basic needs and bringing incomes to a guaranteed minimum level with few other restrictions than a test of means.

The Stiglitz & Yun (2005) result holds for self-insurance. The possibility of pension-funded self-insurance does not eliminate the desirability of some tax-funded insurance, except under extreme circumstances. In addition, Government provides a common pool of resources and is the borrower/lender of last resort which offers huge economies of scale and scope for any specific social benefit compared to what a pooling of separate insurance accounts would provide at an individual level. Clearly, alternative ways of looking at the data, which are tailored in the temporal dimension and targeted to the appropriate segment of population with the benefit category in consideration, are needed for determining their contribution to income risk reduction. A positive function of social benefits in maintaining income is more straightforward to find out.

In neoclassical theory the effects of public policies are taken into account by forward-looking, rational economic agents while economic decisions on labour supply and savings are made. In measuring the extent of risk reduction by the public tax-and-benefit system the paper has used a particular episode in Finnish economy. Construction of the counterfactual case of no public policies is a difficult problem, and the problem is frequently ignored in analysing income distribution and income inequality. The current paper is no exception to the rule. In contrast, Hoynes & Luttner (2011) utilize matching across states to control for differences in state tax-and-transfer policies and decompose the total value of state tax-and-transfer programs into predictable changes in income and unexpected changes in income. The last effect is used to obtain an estimate of the insurance value of state tax-and-transfer programs in the United States. They find the total across person value of state tax-and-transfer programs is approximately 1,000 $ in 2005 dollars at the median real income, with $\gamma = 3$. In the Finnish working age population the risk-adjusted monetary equivalent of redistribution is in the mean 1,400–5,000 € (depending on the age group) larger in 2008 euros than the corresponding redistribution in cash. These figures refer to the (ex post) actual sample values, and the ex ante estimates are substantially larger. In Finland the in-cash tax-and-transfer programs are more extensive than the corresponding state programs in the United States (OECD, Social expenditure database, SOCX). Furthermore, the methodology differs significantly.

The paper considered certainty equivalent incomes which have been controlled for the undesirable effects of income fluctuations over time. The reference point in risk premium calculations was either observed (ex post) or expected (ex ante) mean real income over the observation period. One can have several alternative choices for the reference (status quo) point for risk measurement. The reference point may be based on a shorter or longer term average, or income in the first period and the income changes could be treated asymmetrically with relatively more weight to losses than gains, as in prospect theory by Kahneman & Tversky (1979). Furthermore, there is a special merit in giving the risk of low-income spells and poverty a special status in a thorough dynamic analysis.

Neoclassical economic theory assumes that household utility is based on a flow of consumption not income. Therefore the risk premium should preferably be calculated in terms of consumption. The analysis follows most of the literature in substituting corresponding income variables for consumption, see Carroll (1994), Carroll & Samwick (1998), Creedy et al. (2013) and Hoynes & Luttner (2011).[45] Accounting for saving and borrowing decisions is outside the available data. To uncover joint dynamics of income and consumption processes and to obtain an accurate measure of risk premium would be desirable. However, such panel data sets are mostly unavailable and most of the literature has resorted to using income data instead, Blundell & Etheridge (2010) is a notable exception. Consumption is very difficult to measure accurately due to noise and recall errors and typically requires administrative data, e.g., from credit-card databases or bank holdings. Since there is available no Finnish panel data on consumption, the results in the present paper should be considered as “first approximations” in lack of data.

The recent literature on social insurance emphasizes the liquidity effects in explaining why income shocks that are small relative to life-time wealth have large effects on consumption, Intuitively, benefits increase cash on hand and consumption for an agent who cannot smooth perfectly, see Chetty and Finkelstein (2012).
On the other hand, Baily’s (1978) classic and quite robust formula for the optimal level of social insurance equates the marginal gains from a smoother consumption path with the marginal cost,

[45] In effect one assumes that households consume exactly their disposable income, facing constraints due to incomplete capital and insurance markets constraints, or other constraints, e.g. due to precommited consumption, which rule out buffer-stock savings and prevent the household from "smoothing out" the consumption over time.

measured by the behavioural response in effort, see Chetty and Finkelstein (2012). This gives an even greater urgency on measuring the effects on consumption, but the challenge is estimating the gap in marginal utilities, which requires knowledge of the curvature of utility functions as well as consumption. The first order conditions imply that the relevant risk premium should be defined in terms of marginal utilities as the equivalent precautionary premium, c.f. the case optimal choice of control variables in the theory of precautionary saving, Kimball (1990).

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Table 1. Income dynamics estimation results GMM-MA(2).

	variable	p50	mean	sd	min	max	cells
factor income	β	0.885	0.861	0.111	0.419	0.980	80
	s.e.e	0.001	0.001	0.002	0.000	0.011	80
	s2	0.260	0.278	0.131	0.085	0.633	80
	Fixeff Var	0.028	0.033	0.024	0.007	0.140	80
		-0.128	-0.112	0.116	-0.276	0.473	
gross income	β	0.860	0.834	0.103	0.337	0.949	80
	s.e.e	0.001	0.002	0.003	0.000	0.015	80
	s2	0.067	0.091	0.048	0.039	0.248	80
	Fixeff Var	0.008	0.013	0.017	0.003	0.120	80
		-0.021	-0.028	0.018	-0.087	-0.010	
disp. income	β	0.856	0.831	0.101	0.369	0.943	80
	s.e.e	0.001	0.002	0.003	0.000	0.017	80
	s2	0.057	0.076	0.041	0.033	0.203	80
	Fixeff Var	0.007	0.010	0.013	0.002	0.088	80
		-0.018	-0.024	0.015	-0.071	-0.009	
	obs	13348	25237	26565	672	106464	

Table 2. Ex ante and ex post risk premia in mean income at the population level in 2001-2008.

	variable	mean	sd	min	max	obs
	mean log disp	9.931	0.401	7.090	11.765	252371
	mean log gross	10.201	0.472	7.090	12.174	252371
	mean log factor	9.754	0.985	7.090	12.151	252371
	mean E log disp	9.931	0.398	7.084	11.788	252371
	men E log gross	10.201	0.469	7.085	12.205	252371
	mean E log factor	9.754	0.978	7.035	12.271	252371
γ=1 Ex ante	prem_disp	0.045	0.028	0.021	0.572	252371
	prem_gross	0.055	0.034	0.025	0.630	252371
	prem_factor	0.218	0.114	0.069	0.719	252371
γ=2	prem_disp	0.086	0.050	0.041	0.786	252371
	prem_gross	0.104	0.060	0.050	0.837	252371
	prem_factor	0.376	0.177	0.134	0.923	252371
γ=3	prem_disp	0.123	0.066	0.061	0.851	252371
	prem_gross	0.149	0.079	0.074	0.892	252371
	prem_factor	0.495	0.206	0.194	0.970	252371
γ=4	prem_disp	0.158	0.079	0.080	0.887	252371
	prem_gross	0.190	0.093	0.098	0.920	252371
	prem_factor	0.586	0.217	0.251	0.986	252371
γ=1 Ex post	prem_disp	0.026	0.044	0.000	0.769	252371
	prem_gross	0.030	0.051	0.000	0.817	252371
	prem_factor	0.099	0.141	0.000	0.887	252371
γ=2	prem_disp	0.050	0.082	0.000	0.928	252371
	prem_gross	0.059	0.094	0.000	0.948	252371
	prem_factor	0.177	0.229	0.000	0.954	252371
γ=3	prem_disp	0.071	0.107	0.000	0.956	252371
	prem_gross	0.083	0.120	0.000	0.969	252371
	prem_factor	0.224	0.264	0.000	0.976	252371
γ=4	prem_disp	0.089	0.123	0.000	0.966	252371
	prem_gross	0.102	0.137	0.000	0.976	252371
	prem_factor	0.254	0.278	0.000	0.981	252371

Table 3. Relative risk premia in mean income in 2001-2008.

	variable	p50	mean	sd	min	max	cells
Ex ante risk premium							
γ=1	prem_disp	0.043	0.051	0.022	0.025	0.125	80
	prem_gross	0.055	0.062	0.027	0.032	0.149	80
	prem_factor	0.185	0.217	0.102	0.082	0.425	80
	Δ_factor-gross	0.115	0.155	0.101	0.035	0.350	80
	Δ_gross-disp	0.010	0.011	0.006	0.003	0.028	80
	Δ_factor-disp	0.126	0.166	0.101	0.044	0.362	80
γ=2	prem_disp	0.083	0.098	0.041	0.049	0.229	80
	prem_gross	0.106	0.118	0.049	0.063	0.271	80
	prem_factor	0.329	0.375	0.160	0.154	0.654	80
	Δ_factor-gross	0.199	0.257	0.159	0.062	0.564	80
	Δ_gross-disp	0.018	0.020	0.010	0.006	0.049	80
	Δ_factor-disp	0.217	0.277	0.159	0.081	0.576	80
γ=3	prem_disp	0.121	0.141	0.056	0.072	0.317	80
	prem_gross	0.153	0.169	0.067	0.091	0.371	80
	prem_factor	0.443	0.494	0.191	0.219	0.811	80
	Δ_factor-gross	0.266	0.326	0.192	0.083	0.698	80
	Δ_gross-disp	0.026	0.028	0.013	0.008	0.064	80
	Δ_factor-disp	0.289	0.354	0.192	0.109	0.716	80
γ=4	prem_disp	0.156	0.180	0.069	0.095	0.394	80
	prem_gross	0.196	0.215	0.081	0.118	0.458	80
	prem_factor	0.539	0.586	0.205	0.277	0.905	80
	Δ_factor-gross	0.320	0.372	0.207	0.099	0.768	80
	Δ_gross-disp	0.032	0.035	0.015	0.010	0.074	80
	Δ_factor-disp	0.349	0.407	0.207	0.131	0.790	80
Ex post risk premium							
γ=1	prem_disp	0.024	0.030	0.013	0.015	0.066	80
	prem_gross	0.028	0.036	0.016	0.018	0.079	80
	prem_factor	0.092	0.099	0.043	0.035	0.202	80
	Δ_factor-gross	0.043	0.064	0.042	0.014	0.153	80
	Δ_gross-disp	0.004	0.005	0.003	0.001	0.014	80
	Δ_facto-disp	0.051	0.069	0.042	0.016	0.161	80
γ=2	prem_disp	0.048	0.059	0.026	0.028	0.127	80
	prem_gross	0.056	0.069	0.030	0.034	0.149	80
	prem_factor	0.178	0.179	0.070	0.067	0.346	80
	Δ_factor-gross	0.081	0.111	0.067	0.027	0.256	80
	Δ_gross-disp	0.008	0.010	0.005	0.002	0.027	80
	Δ_factor-disp	0.097	0.120	0.068	0.030	0.263	80
γ=3	prem_disp	0.069	0.083	0.035	0.041	0.174	80
	prem_gross	0.080	0.096	0.041	0.049	0.200	80
	prem_factor	0.234	0.228	0.081	0.091	0.419	80
	Δ_factor-gross	0.101	0.133	0.076	0.034	0.297	80
	Δ_gross-disp	0.011	0.012	0.007	0.003	0.035	80
	Δ_factor-disp	0.121	0.145	0.076	0.038	0.307	80
γ=4	prem_disp	0.086	0.102	0.042	0.052	0.208	80
	prem_gross	0.100	0.117	0.048	0.062	0.237	80
	prem_factor	0.273	0.260	0.085	0.110	0.458	80
	Δ_factor-gross	0.111	0.143	0.078	0.039	0.315	80
	Δ_gross-disp	0.012	0.014	0.007	0.004	0.039	80
	Δ_factor-disp	0.133	0.157	0.079	0.043	0.326	80
	obs	13348	25237	26565	672	106464	

Table 4. The extent of risk reduction by age, education level and socio economic statuts, results from a weighted regression.

	Ex ante risk premium				Ex post risk premium		
	Coefficient	Std. Err.	t-value		Coefficient	Std. Err.	t-value
Age in 2000:							
30-39	-0.018	0.029	-0.61		-0.034	0.012	-2.93***
40-49	0.004	0.029	0.16		-0.048	0.012	-4.17***
50-59	0.304	0.029	10.33***		0.089	0.012	7.42***
Education level in 2000:							
upper & post secondary	-0.039	0.025	-1.55		-0.019	0.010	-1.85
lowest level tertiary	-0.084	0.034	-2.49**		-0.039	0.014	-2.86***
at least Bachelor, or equivalent	-0.116	0.041	-2.79***		-0.059	0.017	-3.51***
Socio economic status in 2000:							
upper white collar employees	0.092	0.049	1.89		0.019	0.020	0.96
lower white collar employees	0.101	0.040	2.52**		0.018	0.016	1.12
blue collar workers	0.138	0.040	3.47***		0.034	0.016	2.09*
students, pensioners or,							
long-term unemployed	0.278	0.040	6.87***		0.113	0.016	6.88***
constant	0.200	0.046	4.35***		0.130	0.019	7.00***
R-squared	0.8219				0.8467		
root MSE	0.0869				0.0352		
Cells	80				80		
Sum of weights	2018968				2018968		

Notes: Dependent variable: Difference between risk premium in factor and disposable income, calculated with the coefficient of relative risk aversion, $\gamma = 3$, weighted regression with (cell) weights equal to the number of observations in the cell. *** p<0.001, ** p<0.01, * p<0.05.

Table 5. Estimation results from a weighted regression for difference in risk premium.

	Ex ante risk premium			Ex post risk premium		
	Coefficient	Std. Err.	t-value	Coefficient	Std. Err.	t-value
Sickness/Health care	9.852	4.530	2.17**	4.800	1.763	2.72***
Disability	-4.201	0.665	-6.32***	-1.827	0.259	-7.06***
Old age	3.126	0.455	6.88***	1.252	0.177	7.08***
Survivors	-10.005	8.947	-1.12	2.517	3.483	0.72
Family/children	-3.714	0.837	-4.44***	-0.328	0.326	-1.01
Unemployment	5.841	0.937	6.24***	2.411	0.365	6.61***
Housing	12.481	7.431	1.68	2.284	2.893	0.79
Social exclusion	-6.038	5.319	-1.14	3.699	2.071	1.79
Student	-11.094	8.598	-1.29	-2.315	3.347	-0.69
Education level in 2000						
upper & post secondary	-0.014	0.026	-0.55	-0.007	0.010	-0.73
lowest level tertiary	-0.035	0.037	-0.95	-0.005	0.015	-0.32
at least Bachelor, or equivalent	-0.037	0.046	-0.82	0.003	0.018	0.19
constant	0.234	0.066	3.55	0.016	0.026	0.62
R-squared	0.8792			0.9002		
root MSE	0.0724			0.0282		
Cells	80			80		
Sum of weights	2018968			2018968		

Notes: Dependent variable: Difference between risk premium in factor and gross income, calculated with the coefficient of relative risk aversion, $\gamma = 3$, weighted regression with (cell) weights proportional to the number of observations in the cell. *** p<0.001, ** p<0.01, * p<0.05.

Figure 1. Age profiles of the Gini coefficients of mean equivalised household income and risk-adjusted income, $\rho = 3$, in 2001–2008.

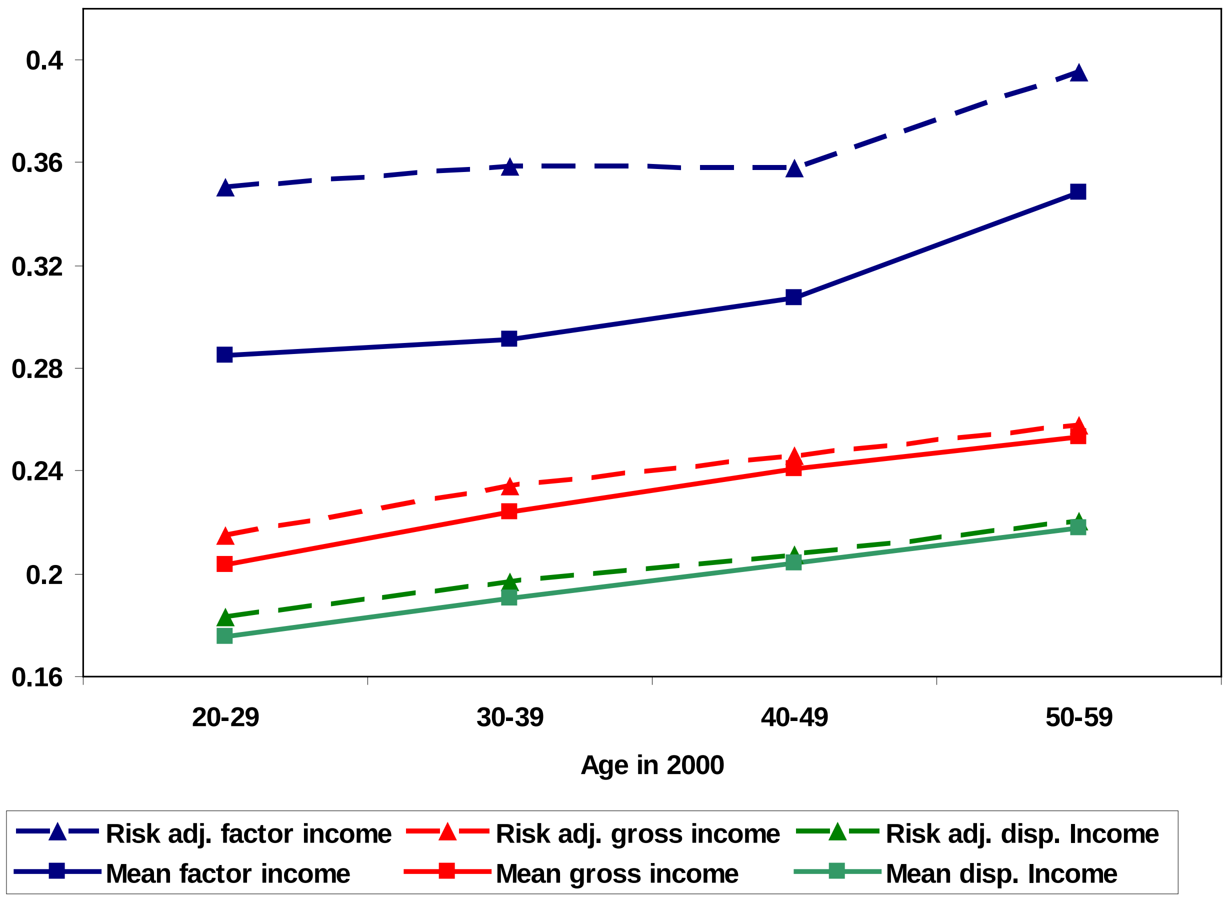
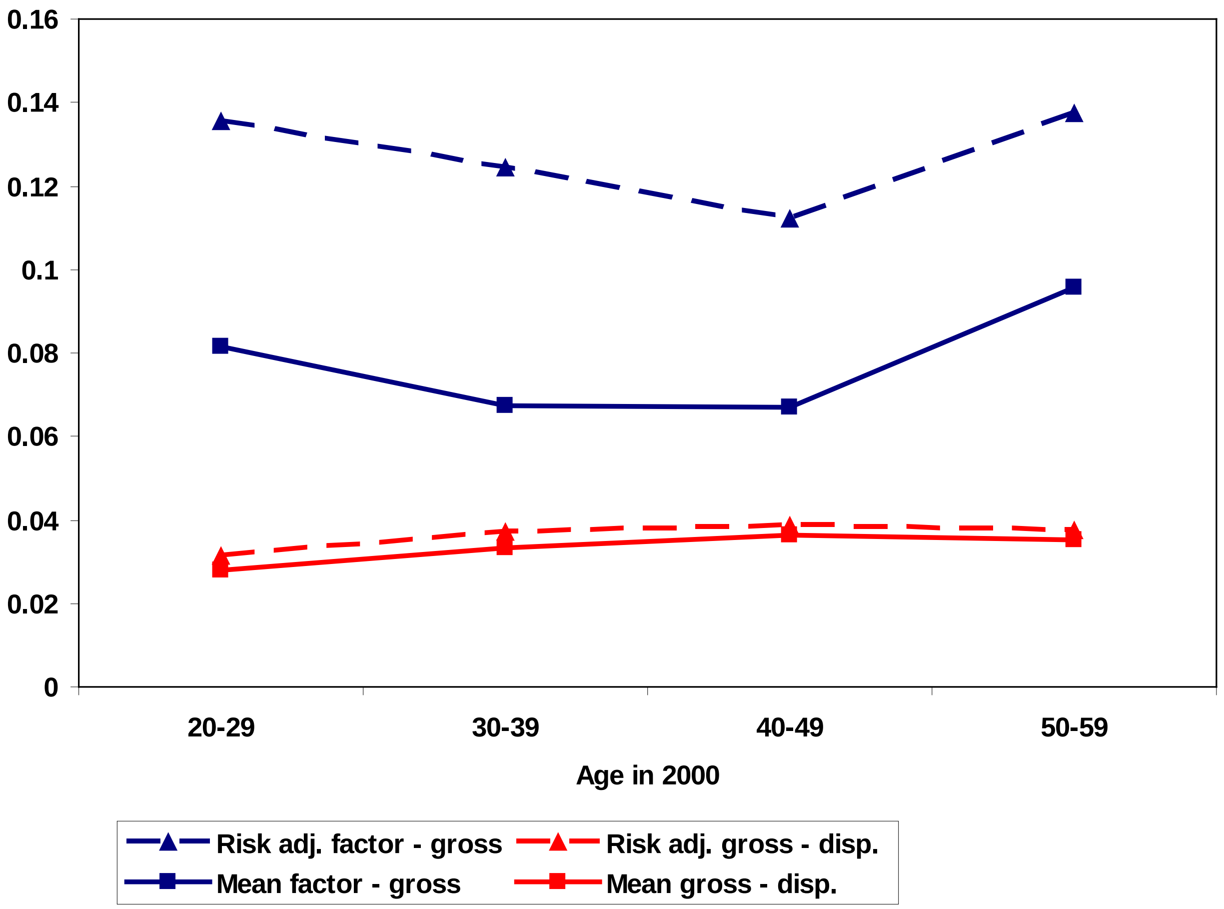


Figure 2. Age profiles of redistribution (difference of Gini coefficients) in mean equivalised household income and in risk-adjusted income, $\rho = 3$, in 2001–2008.



Appendix

Below the estimators of relative risk premium are reported for real equivalised disposable household income in the 2001–2008 income panel data with $\rho = 3,$ by age and education level (4 levels) and socio-economic status (5 classes). Estimators are based on the means of the individual risk premia in the population stratum in question.

The classifications in Tables A1-A5 are coded as follows

Socio-economic status	**Code**
self-employed or farmer	2
upper white collar employees	3
lower white collar employees	4
blue collar workers	5
students, pensioners or, long-term unemployed	6
Education level	**Code**
primary or unknown	0
upper & post secondary	1
lowest level tertiary	2
at least Bachelor, or equivalent	3

Table A1. Estimation results from a dynamic mobility of factor income in the 2000–2008 panel, by age (4 groups), education level (4 levels) and socio-economic status (5 classes) in 2000.

Age in 2000	Education level	socio-ec. status	β	s.e.e.	s2	Sargan	LM(L_2)	Fixeff Var	Cov(e_1,e_2)	Obs.
20-29	0	2	0.8335	0.0651	0.4710	0.8405	0.0008	0.0374	-0.1474	2704
20-29	0	3	0.8743	0.0404	0.4331	0.3741	0.1269	0.0456	-0.1176	1424
20-29	0	4	0.7747	0.0353	0.3288	0.2239	0.9085	0.0433	-0.0673	8008
20-29	0	5	0.8630	0.0172	0.3523	0.0304	0.5710	0.0280	-0.0890	24728
20-29	0	6	0.8779	0.0158	0.6334	0.4447	0.0034	0.0515	-0.1770	27328
20-29	1	2	0.7983	0.0421	0.3458	0.5735	0.0004	0.0320	-0.1120	7760
20-29	1	3	0.7918	0.0215	0.2573	0.1391	0.0253	0.0317	-0.0622	12536
20-29	1	4	0.8023	0.0150	0.2420	0.9849	0.7748	0.0243	-0.0557	52920
20-29	1	5	0.8060	0.0111	0.2305	0.0027	0.0053	0.0236	-0.0552	100112
20-29	1	6	0.8043	0.0112	0.4732	0.0000	0.0000	0.0500	-0.1228	106464
20-29	2	2	0.6213	0.0786	0.2561	0.6786	0.2780	0.0663	-0.0679	1576
20-29	2	3	0.6196	0.0609	0.1470	0.2942	0.6235	0.0432	-0.0171	4656
20-29	2	4	0.7869	0.0214	0.1467	0.3298	0.6776	0.0172	-0.0327	26184
20-29	2	5	0.8158	0.0418	0.1824	0.1308	0.5565	0.0192	-0.0415	8304
20-29	2	6	0.8477	0.0344	0.4089	0.3732	0.5642	0.0380	-0.1101	9288
20-29	3	2	0.4190	0.0655	0.2253	0.4784	0.2349	0.1404	-0.0489	672
20-29	3	3	0.8491	0.0242	0.1279	0.3520	0.9769	0.0109	-0.0341	21440
20-29	3	4	0.7906	0.0338	0.1286	0.6001	0.5685	0.0153	-0.0310	13400
20-29	3	5	0.9121	0.0290	0.1844	0.6227	0.0857	0.0132	-0.0398	2304
20-29	3	6	0.7920	0.0564	0.3458	0.3227	0.6973	0.0377	-0.0786	7128
30-39	0	2	0.7404	0.0627	0.3331	0.0898	0.0265	0.0490	-0.1039	7136
30-39	0	3	0.8771	0.0507	0.2468	0.2926	0.6819	0.0262	-0.0711	2496
30-39	0	4	0.8333	0.0267	0.1859	0.0073	0.9350	0.0257	-0.0418	12976
30-39	0	5	0.8888	0.0158	0.2204	0.2118	0.4956	0.0189	-0.0566	31720
30-39	0	6	0.9516	0.0142	0.5178	0.3737	0.0033	0.0303	-0.1634	25672
30-39	1	2	0.8678	0.0223	0.2958	0.6605	0.0000	0.0217	-0.1104	24048
30-39	1	3	0.8127	0.0359	0.1600	0.7015	0.3559	0.0227	-0.0402	10864
30-39	1	4	0.8782	0.0177	0.1415	0.0003	0.0885	0.0128	-0.0362	57704
30-39	1	5	0.8503	0.0122	0.1476	0.0000	0.0025	0.0156	-0.0353	103992
30-39	1	6	0.9296	0.0142	0.4687	0.2569	0.1440	0.0307	-0.1344	44896
30-39	2	2	0.4995	0.0661	0.1943	0.0079	0.0000	0.1074	-0.0408	7016
30-39	2	3	0.8839	0.0268	0.1355	0.0143	0.9646	0.0119	-0.0376	15040
30-39	2	4	0.8575	0.0157	0.1142	0.3670	0.6627	0.0113	-0.0273	66704
30-39	2	5	0.8239	0.0299	0.1522	0.0290	0.9388	0.0192	-0.0343	11360
30-39	2	6	0.8704	0.0270	0.3741	0.0429	0.1405	0.0376	-0.0974	13544
30-39	3	2	0.5181	0.1052	0.1735	0.3073	0.0034	0.1280	-0.0316	2472
30-39	3	3	0.8395	0.0270	0.0981	0.0000	0.4898	0.0121	-0.0236	56776
30-39	3	4	0.8526	0.0386	0.1053	0.2945	0.4787	0.0128	-0.0260	14192
30-39	3	5	0.6580	0.0928	0.1272	0.2951	0.2292	0.0556	-0.0236	2160
30-39	3	6	0.9527	0.0426	0.4523	0.0682	0.1474	0.0284	-0.1294	8176
40-49	0	2	0.8964	0.0325	0.3038	0.9841	0.0000	0.0207	-0.1118	14904
40-49	0	3	0.7521	0.0542	0.1413	0.0997	0.1534	0.0388	-0.0248	3240
40-49	0	4	0.9755	0.0156	0.1515	0.3538	0.1480	0.0119	-0.0392	26408
40-49	0	5	0.9494	0.0093	0.1758	0.9131	0.0119	0.0144	-0.0478	52456
40-49	0	6	0.9440	0.0126	0.4382	0.2370	0.0001	0.0280	-0.1420	33504
40-49	1	2	0.8860	0.0251	0.2776	0.6508	0.0000	0.0203	-0.1009	26888
40-49	1	3	0.8807	0.0327	0.1417	0.0893	0.5651	0.0172	-0.0309	10240
40-49	1	4	0.9537	0.0110	0.1308	0.2974	0.0933	0.0105	-0.0342	63536
40-49	1	5	0.9418	0.0089	0.1518	0.0707	0.0001	0.0128	-0.0399	98424
40-49	1	6	0.9703	0.0124	0.4816	0.0004	0.0055	0.0249	-0.1535	45816
40-49	2	2	0.8861	0.0426	0.2561	0.0586	0.0010	0.0190	-0.0859	8296
40-49	2	3	0.8749	0.0302	0.1000	0.1400	0.0149	0.0129	-0.0270	14080
40-49	2	4	0.9168	0.0136	0.1035	0.8667	0.0006	0.0089	-0.0291	60760
40-49	2	5	0.9351	0.0400	0.1851	0.3621	0.0218	0.0137	-0.0621	6600
40-49	2	6	0.9609	0.0268	0.4669	0.2316	0.4390	0.0282	-0.1340	10688
40-49	3	2	0.6293	0.0769	0.2130	0.4142	0.1292	0.0844	-0.0455	3992
40-49	3	3	0.9172	0.0193	0.0854	0.0165	0.0272	0.0083	-0.0215	52616
40-49	3	4	0.9473	0.0192	0.1082	0.2430	0.1776	0.0071	-0.0336	10048
40-49	3	5	0.9108	0.0630	0.2080	0.5592	0.5516	0.0217	-0.0439	1336
40-49	3	6	0.8255	0.0524	0.4199	0.1103	0.4835	0.0689	-0.1117	6168
50-59	0	2	0.9376	0.0138	0.4350	0.9183	0.0000	0.0275	-0.1528	23104
50-59	0	3	0.9308	0.0177	0.3518	0.6467	0.0456	0.0437	-0.0813	4712
50-59	0	4	0.9331	0.0056	0.3168	0.0097	0.4016	0.0402	-0.0576	37280
50-59	0	5	0.9227	0.0042	0.3284	0.0000	0.5130	0.0427	-0.0559	67120
50-59	0	6	0.9114	0.0099	0.4672	0.0076	0.0000	0.0320	-0.1490	78048
50-59	1	2	0.9381	0.0179	0.3921	0.8787	0.0000	0.0266	-0.1290	18320
50-59	1	3	0.9379	0.0141	0.3124	0.1552	0.5670	0.0400	-0.0626	7656
50-59	1	4	0.9462	0.0055	0.3081	0.0202	0.8943	0.0373	-0.0590	42960
50-59	1	5	0.9505	0.0051	0.2917	0.0567	0.2735	0.0338	-0.0565	55904
50-59	1	6	0.9222	0.0108	0.4767	0.0315	0.0000	0.0325	-0.1489	49240

50-59	2	2	0.9458	0.0366	0.3603	0.5610	0.4543	0.0204	-0.1205	4992
50-59	2	3	0.9445	0.0083	0.3432	0.3024	0.8752	0.0429	-0.0653	12896
50-59	2	4	0.9618	0.0062	0.2728	0.0006	0.1007	0.0326	-0.0528	35480
50-59	2	5	0.9308	0.0180	0.2845	0.3739	0.9746	0.0342	-0.0561	3472
50-59	2	6	0.9458	0.0183	0.4979	0.1019	0.0176	0.0336	-0.1463	13296
50-59	3	2	0.9575	0.0548	0.3262	0.5800	0.0113	0.0212	-0.1201	3024
50-59	3	3	0.9680	0.0072	0.2513	0.0769	0.2439	0.0313	-0.0488	38312
50-59	3	4	0.9801	0.0141	0.2627	0.1386	0.5225	0.0297	-0.0456	6760
50-59	3	5	0.9507	0.0325	0.3310	0.6956	0.0300	0.0369	-0.0431	840
50-59	3	6	0.9054	0.0252	0.5284	0.0120	0.0041	0.0466	-0.1557	7672

Table A2. Estimation results from a dynamic mobility of gross income in the 2000–2008 panel, by age (4 groups), education level (4 levels) and socio-economic status (5 classes) in 2000.

Age in 2000	Education level	socio-ec. status	β	s.e.e.	s2	Sargan	LM(L_2)	Fixeff Var	Cov(e_1,e_2)	Obs.
20-29	0	2	0.8745	0.0732	0.2479	0.8766	0.0006	0.0148	-0.0867	2704
20-29	0	3	0.8188	0.0417	0.1527	0.3996	0.2251	0.0214	-0.0454	1424
20-29	0	4	0.7692	0.0414	0.1080	0.9863	0.0051	0.0131	-0.0283	8008
20-29	0	5	0.8005	0.0265	0.0943	0.1499	0.0037	0.0095	-0.0292	24728
20-29	0	6	0.8333	0.0278	0.1370	0.0003	0.0000	0.0119	-0.0416	27328
20-29	1	2	0.7819	0.0509	0.1765	0.8120	0.0006	0.0153	-0.0591	7760
20-29	1	3	0.8270	0.0193	0.1246	0.0219	0.0176	0.0133	-0.0342	12536
20-29	1	4	0.8426	0.0159	0.1056	0.7376	0.0448	0.0095	-0.0276	52920
20-29	1	5	0.8259	0.0124	0.0829	0.0327	0.0000	0.0078	-0.0222	100112
20-29	1	6	0.8046	0.0118	0.1609	0.0003	0.0000	0.0155	-0.0460	106464
20-29	2	2	0.6000	0.0917	0.1676	0.5573	0.0171	0.0364	-0.0565	1576
20-29	2	3	0.6667	0.0559	0.0627	0.5058	0.9320	0.0173	-0.0101	4656
20-29	2	4	0.8269	0.0204	0.0620	0.0305	0.0218	0.0071	-0.0152	26184
20-29	2	5	0.8127	0.0469	0.0659	0.0357	0.0164	0.0078	-0.0177	8304
20-29	2	6	0.8856	0.0294	0.1188	0.5962	0.2342	0.0099	-0.0309	9288
20-29	3	2	0.3368	0.0579	0.1134	0.1558	0.3776	0.1203	-0.0208	672
20-29	3	3	0.8566	0.0212	0.0625	0.2676	0.5573	0.0068	-0.0157	21440
20-29	3	4	0.8407	0.0316	0.0602	0.0956	0.3112	0.0070	-0.0140	13400
20-29	3	5	0.8563	0.0795	0.0826	0.9413	0.0966	0.0080	-0.0176	2304
20-29	3	6	0.7575	0.0364	0.1233	0.2763	0.0798	0.0185	-0.0313	7128
30-39	0	2	0.7347	0.0713	0.1771	0.2919	0.0197	0.0231	-0.0599	7136
30-39	0	3	0.7470	0.0553	0.0959	0.1374	0.3989	0.0286	-0.0270	2496
30-39	0	4	0.7391	0.0373	0.0553	0.0028	0.1013	0.0136	-0.0139	12976
30-39	0	5	0.8891	0.0222	0.0608	0.5316	0.0004	0.0049	-0.0191	31720
30-39	0	6	0.9280	0.0273	0.0958	0.4301	0.0015	0.0061	-0.0319	25672
30-39	1	2	0.8422	0.0286	0.1548	0.7151	0.0000	0.0117	-0.0617	24048
30-39	1	3	0.8603	0.0329	0.0736	0.6210	0.0291	0.0081	-0.0225	10864
30-39	1	4	0.8799	0.0186	0.0544	0.0015	0.0000	0.0052	-0.0162	57704
30-39	1	5	0.8895	0.0138	0.0445	0.0145	0.0000	0.0038	-0.0129	103992
30-39	1	6	0.8777	0.0183	0.0923	0.5899	0.0000	0.0087	-0.0282	44896
30-39	2	2	0.5884	0.0672	0.1241	0.0701	0.0000	0.0414	-0.0352	7016
30-39	2	3	0.9069	0.0305	0.0601	0.2863	0.0743	0.0053	-0.0179	15040
30-39	2	4	0.8650	0.0170	0.0472	0.1839	0.0001	0.0051	-0.0129	66704
30-39	2	5	0.8326	0.0302	0.0501	0.2945	0.0509	0.0060	-0.0145	11360
30-39	2	6	0.8243	0.0381	0.0933	0.6401	0.0759	0.0126	-0.0248	13544
30-39	3	2	0.5191	0.1219	0.1037	0.2257	0.0016	0.0843	-0.0218	2472
30-39	3	3	0.8912	0.0235	0.0495	0.0000	0.0145	0.0049	-0.0133	56776
30-39	3	4	0.8533	0.0339	0.0476	0.0504	0.1828	0.0065	-0.0119	14192
30-39	3	5	0.5626	0.1094	0.0583	0.3108	0.1716	0.0330	-0.0156	2160
30-39	3	6	0.9187	0.0537	0.1495	0.5640	0.2701	0.0115	-0.0406	8176
40-49	0	2	0.8636	0.0389	0.1812	0.6111	0.0000	0.0135	-0.0696	14904
40-49	0	3	0.8546	0.0307	0.0772	0.3619	0.3722	0.0107	-0.0197	3240
40-49	0	4	0.8793	0.0279	0.0515	0.0971	0.0096	0.0054	-0.0155	26408
40-49	0	5	0.9312	0.0133	0.0434	0.9966	0.0008	0.0034	-0.0133	52456
40-49	0	6	0.8945	0.0233	0.0733	0.2175	0.0000	0.0062	-0.0252	33504
40-49	1	2	0.8683	0.0272	0.1653	0.7633	0.0000	0.0117	-0.0636	26888
40-49	1	3	0.8263	0.0363	0.0659	0.2177	0.0579	0.0103	-0.0186	10240
40-49	1	4	0.9162	0.0164	0.0475	0.0079	0.0000	0.0040	-0.0157	63536
40-49	1	5	0.9062	0.0112	0.0389	0.0287	0.0000	0.0035	-0.0122	98424
40-49	1	6	0.9195	0.0196	0.0864	0.0236	0.0001	0.0059	-0.0303	45816
40-49	2	2	0.8080	0.0491	0.1598	0.2163	0.0002	0.0168	-0.0558	8296
40-49	2	3	0.8845	0.0220	0.0475	0.5263	0.0071	0.0052	-0.0138	14080
40-49	2	4	0.8904	0.0162	0.0429	0.7459	0.0000	0.0042	-0.0136	60760
40-49	2	5	0.8602	0.0376	0.0484	0.4139	0.0136	0.0062	-0.0143	6600
40-49	2	6	0.8688	0.0326	0.1004	0.0564	0.0093	0.0115	-0.0319	10688
40-49	3	2	0.6859	0.0811	0.1540	0.6579	0.0410	0.0423	-0.0418	3992
40-49	3	3	0.8956	0.0171	0.0391	0.0063	0.0000	0.0043	-0.0119	52616
40-49	3	4	0.9489	0.0216	0.0502	0.1652	0.0013	0.0036	-0.0179	10048
40-49	3	5	0.9279	0.0251	0.0672	0.4381	0.0971	0.0101	-0.0177	1336
40-49	3	6	0.8503	0.0634	0.1329	0.0970	0.0954	0.0166	-0.0444	6168
50-59	0	2	0.8683	0.0288	0.1911	0.2689	0.0000	0.0119	-0.0747	23104
50-59	0	3	0.7610	0.0526	0.0644	0.5724	0.0024	0.0162	-0.0230	4712
50-59	0	4	0.9157	0.0154	0.0468	0.3639	0.0000	0.0037	-0.0155	37280
50-59	0	5	0.9094	0.0119	0.0415	0.2586	0.0000	0.0034	-0.0132	67120
50-59	0	6	0.8817	0.0294	0.0618	0.0112	0.0000	0.0050	-0.0226	78048
50-59	1	2	0.8909	0.0457	0.1690	0.9076	0.0001	0.0091	-0.0624	18320
50-59	1	3	0.8307	0.0276	0.0591	0.4291	0.0041	0.0091	-0.0173	7656
50-59	1	4	0.9076	0.0141	0.0470	0.1033	0.0000	0.0041	-0.0152	42960
50-59	1	5	0.9418	0.0132	0.0418	0.0515	0.0000	0.0030	-0.0138	55904
50-59	1	6	0.9026	0.0214	0.0616	0.0275	0.0000	0.0044	-0.0221	49240

50-59	2	2	0.7574	0.0992	0.1587	0.0738	0.2595	0.0228	-0.0578	4992
50-59	2	3	0.8444	0.0352	0.0420	0.5823	0.0000	0.0060	-0.0119	12896
50-59	2	4	0.9420	0.0176	0.0449	0.0093	0.0000	0.0032	-0.0146	35480
50-59	2	5	0.8530	0.0495	0.0572	0.4517	0.0394	0.0061	-0.0200	3472
50-59	2	6	0.8953	0.0454	0.0647	0.3122	0.0575	0.0056	-0.0214	13296
50-59	3	2	0.8826	0.1037	0.1746	0.2824	0.0318	0.0121	-0.0662	3024
50-59	3	3	0.9293	0.0164	0.0394	0.1626	0.0007	0.0034	-0.0121	38312
50-59	3	4	0.9185	0.0347	0.0513	0.0493	0.7213	0.0046	-0.0157	6760
50-59	3	5	0.8984	0.0940	0.0629	0.2804	0.2226	0.0056	-0.0170	840
50-59	3	6	0.7731	0.0778	0.0917	0.0114	0.0005	0.0232	-0.0248	7672

Table A3. Estimation results from a dynamic mobility of disposable income in the 2000–2008 panel, by age (4 groups), education level (4 levels) and socio-economic status (5 classes) in 2000.

Age in 2000	Education level	socio-ec. status	β	s.e.e.	s2	Sargan	LM(L_2)	Fixeff Var	Cov(e_1,e_2)	Obs.
20-29	0	2	0.8727	0.0683	0.2028	0.8816	0.0019	0.0121	-0.0709	2704
20-29	0	3	0.7753	0.0444	0.1206	0.3291	0.2407	0.0197	-0.0350	1424
20-29	0	4	0.7561	0.0426	0.0843	0.9901	0.0022	0.0104	-0.0226	8008
20-29	0	5	0.7951	0.0287	0.0748	0.1474	0.0035	0.0073	-0.0239	24728
20-29	0	6	0.8314	0.0300	0.1080	0.0006	0.0000	0.0089	-0.0342	27328
20-29	1	2	0.7734	0.0540	0.1441	0.8524	0.0003	0.0124	-0.0490	7760
20-29	1	3	0.8152	0.0212	0.0960	0.1129	0.0059	0.0102	-0.0273	12536
20-29	1	4	0.8449	0.0172	0.0835	0.7458	0.0130	0.0070	-0.0229	52920
20-29	1	5	0.8225	0.0130	0.0653	0.0721	0.0000	0.0060	-0.0180	100112
20-29	1	6	0.8049	0.0125	0.1248	0.0073	0.0000	0.0115	-0.0372	106464
20-29	2	2	0.6188	0.0930	0.1370	0.5937	0.0105	0.0273	-0.0477	1576
20-29	2	3	0.6582	0.0558	0.0497	0.4610	0.7514	0.0131	-0.0089	4656
20-29	2	4	0.8227	0.0215	0.0495	0.0287	0.0043	0.0055	-0.0126	26184
20-29	2	5	0.8256	0.0493	0.0534	0.0415	0.0199	0.0055	-0.0149	8304
20-29	2	6	0.8898	0.0297	0.0936	0.7892	0.1447	0.0074	-0.0252	9288
20-29	3	2	0.3686	0.0547	0.0963	0.1693	0.3450	0.0883	-0.0213	672
20-29	3	3	0.8439	0.0221	0.0505	0.1364	0.1394	0.0055	-0.0131	21440
20-29	3	4	0.8180	0.0345	0.0480	0.0598	0.2332	0.0058	-0.0113	13400
20-29	3	5	0.8474	0.0843	0.0651	0.8864	0.0713	0.0063	-0.0136	2304
20-29	3	6	0.7524	0.0379	0.0970	0.2478	0.0608	0.0145	-0.0263	7128
30-39	0	2	0.7209	0.0731	0.1463	0.2497	0.0149	0.0202	-0.0498	7136
30-39	0	3	0.7378	0.0559	0.0797	0.2177	0.3838	0.0231	-0.0226	2496
30-39	0	4	0.7319	0.0376	0.0452	0.0040	0.0659	0.0104	-0.0118	12976
30-39	0	5	0.8840	0.0218	0.0494	0.6520	0.0001	0.0039	-0.0158	31720
30-39	0	6	0.9352	0.0283	0.0793	0.4820	0.0018	0.0047	-0.0270	25672
30-39	1	2	0.8464	0.0290	0.1301	0.7257	0.0000	0.0092	-0.0522	24048
30-39	1	3	0.8459	0.0345	0.0594	0.5280	0.0124	0.0068	-0.0184	10864
30-39	1	4	0.8793	0.0183	0.0444	0.0131	0.0000	0.0041	-0.0137	57704
30-39	1	5	0.8909	0.0139	0.0364	0.0327	0.0000	0.0029	-0.0108	103992
30-39	1	6	0.8721	0.0194	0.0754	0.4459	0.0000	0.0069	-0.0236	44896
30-39	2	2	0.5993	0.0708	0.1052	0.0937	0.0000	0.0315	-0.0309	7016
30-39	2	3	0.9107	0.0311	0.0498	0.3349	0.0201	0.0042	-0.0152	15040
30-39	2	4	0.8605	0.0172	0.0388	0.2154	0.0000	0.0041	-0.0110	66704
30-39	2	5	0.8281	0.0301	0.0406	0.4682	0.0221	0.0047	-0.0121	11360
30-39	2	6	0.8273	0.0397	0.0768	0.6574	0.0710	0.0094	-0.0214	13544
30-39	3	2	0.5303	0.1304	0.0871	0.1810	0.0142	0.0638	-0.0194	2472
30-39	3	3	0.8993	0.0226	0.0418	0.0007	0.0014	0.0037	-0.0118	56776
30-39	3	4	0.8552	0.0345	0.0399	0.0701	0.1425	0.0050	-0.0102	14192
30-39	3	5	0.5466	0.1144	0.0471	0.3309	0.1615	0.0265	-0.0122	2160
30-39	3	6	0.9190	0.0573	0.1229	0.7158	0.2256	0.0091	-0.0340	8176
40-49	0	2	0.8681	0.0382	0.1580	0.7133	0.0000	0.0111	-0.0619	14904
40-49	0	3	0.8576	0.0297	0.0659	0.1724	0.3143	0.0084	-0.0179	3240
40-49	0	4	0.8751	0.0278	0.0436	0.0777	0.0034	0.0044	-0.0135	26408
40-49	0	5	0.9232	0.0134	0.0366	0.9942	0.0003	0.0028	-0.0115	52456
40-49	0	6	0.8949	0.0240	0.0628	0.1570	0.0000	0.0049	-0.0222	33504
40-49	1	2	0.8788	0.0249	0.1451	0.6810	0.0000	0.0094	-0.0570	26888
40-49	1	3	0.8128	0.0356	0.0552	0.1481	0.0431	0.0087	-0.0158	10240
40-49	1	4	0.9121	0.0154	0.0411	0.0087	0.0000	0.0034	-0.0139	63536
40-49	1	5	0.9018	0.0112	0.0331	0.0168	0.0000	0.0029	-0.0106	98424
40-49	1	6	0.9208	0.0202	0.0745	0.0304	0.0000	0.0047	-0.0270	45816
40-49	2	2	0.8283	0.0477	0.1396	0.2728	0.0001	0.0124	-0.0501	8296
40-49	2	3	0.8811	0.0222	0.0408	0.5582	0.0044	0.0043	-0.0122	14080
40-49	2	4	0.8932	0.0161	0.0376	0.6380	0.0000	0.0034	-0.0122	60760
40-49	2	5	0.8618	0.0359	0.0407	0.4552	0.0122	0.0048	-0.0124	6600
40-49	2	6	0.8673	0.0347	0.0856	0.0824	0.0086	0.0091	-0.0275	10688
40-49	3	2	0.7087	0.0733	0.1338	0.5596	0.0514	0.0306	-0.0379	3992
40-49	3	3	0.9073	0.0163	0.0349	0.0015	0.0000	0.0032	-0.0110	52616
40-49	3	4	0.9429	0.0208	0.0435	0.4678	0.0004	0.0031	-0.0157	10048
40-49	3	5	0.9394	0.0204	0.0570	0.4737	0.1358	0.0077	-0.0168	1336
40-49	3	6	0.8528	0.0626	0.1116	0.0801	0.1365	0.0130	-0.0371	6168
50-59	0	2	0.8701	0.0291	0.1703	0.1795	0.0000	0.0099	-0.0682	23104
50-59	0	3	0.7021	0.0618	0.0525	0.4966	0.0026	0.0176	-0.0184	4712
50-59	0	4	0.9104	0.0174	0.0399	0.1416	0.0000	0.0030	-0.0135	37280
50-59	0	5	0.8980	0.0131	0.0349	0.4110	0.0000	0.0028	-0.0116	67120
50-59	0	6	0.8735	0.0309	0.0529	0.0266	0.0000	0.0041	-0.0196	78048
50-59	1	2	0.8897	0.0457	0.1500	0.9685	0.0003	0.0077	-0.0560	18320
50-59	1	3	0.8149	0.0286	0.0494	0.6525	0.0016	0.0079	-0.0150	7656
50-59	1	4	0.9029	0.0147	0.0406	0.0819	0.0000	0.0033	-0.0136	42960
50-59	1	5	0.9347	0.0142	0.0357	0.1293	0.0000	0.0024	-0.0122	55904
50-59	1	6	0.9039	0.0205	0.0534	0.0128	0.0000	0.0034	-0.0197	49240

50-59	2	2	0.7642	0.0814	0.1450	0.1473	0.3169	0.0185	-0.0521	4992
50-59	2	3	0.8296	0.0378	0.0362	0.6619	0.0000	0.0052	-0.0108	12896
50-59	2	4	0.9407	0.0182	0.0394	0.0008	0.0000	0.0026	-0.0133	35480
50-59	2	5	0.8236	0.0514	0.0472	0.2499	0.0325	0.0057	-0.0164	3472
50-59	2	6	0.9037	0.0475	0.0577	0.3339	0.0778	0.0042	-0.0194	13296
50-59	3	2	0.8393	0.1039	0.1466	0.3765	0.0345	0.0141	-0.0554	3024
50-59	3	3	0.9147	0.0190	0.0349	0.4780	0.0000	0.0029	-0.0113	38312
50-59	3	4	0.8891	0.0416	0.0448	0.0338	0.2634	0.0046	-0.0147	6760
50-59	3	5	0.8820	0.0879	0.0513	0.3754	0.2798	0.0049	-0.0143	840
50-59	3	6	0.7792	0.0763	0.0796	0.0274	0.0004	0.0171	-0.0225	7672

Table A4. Expected mean log income and relative risk premia (with $\gamma = 3$) in the 2000–2008 panel data, by age (4 groups), education level (4 levels) and socio-economic status (5 classes) in 2000.

Age in 2000	Education level	socio-ec. status	Expected log Disp income	Gross income	Factor inc.	Risk premium Disp income	Gross income	Factor inc.	Obs.
20-29	0	2	9.6742	9.8885	9.5508	0.3168	0.3715	0.6031	2704
20-29	0	3	9.8642	10.1292	9.7559	0.2127	0.2725	0.6583	1424
20-29	0	4	9.8238	10.0711	9.7667	0.1585	0.2017	0.5342	8008
20-29	0	5	9.8006	10.0421	9.6945	0.1309	0.1656	0.5836	24728
20-29	0	6	9.5504	9.7223	8.7888	0.2016	0.2564	0.7888	27328
20-29	1	2	9.8369	10.0674	9.8136	0.2256	0.2716	0.4692	7760
20-29	1	3	10.0477	10.3459	10.1781	0.1974	0.2548	0.4460	12536
20-29	1	4	9.9495	10.2180	10.0298	0.1866	0.2335	0.4393	52920
20-29	1	5	9.9012	10.1611	9.9456	0.1410	0.1768	0.4130	100112
20-29	1	6	9.7581	9.9865	9.5651	0.2455	0.3090	0.6662	106464
20-29	2	2	9.9513	10.1955	9.9878	0.1927	0.2285	0.3619	1576
20-29	2	3	10.0663	10.3687	10.2270	0.1027	0.1294	0.2671	4656
20-29	2	4	10.0309	10.3182	10.1782	0.1164	0.1449	0.2890	26184
20-29	2	5	9.9351	10.2013	10.0090	0.1157	0.1390	0.3575	8304
20-29	2	6	9.8264	10.0718	9.6926	0.2346	0.2896	0.6341	9288
20-29	3	2	9.9873	10.2527	10.0606	0.1444	0.1679	0.3038	672
20-29	3	3	10.2192	10.5590	10.4569	0.1230	0.1544	0.2638	21440
20-29	3	4	10.1604	10.4802	10.3709	0.1196	0.1522	0.2553	13400
20-29	3	5	10.0611	10.3582	10.2142	0.1731	0.2144	0.4500	2304
20-29	3	6	9.9557	10.2322	9.9826	0.2009	0.2540	0.5757	7128
30-39	0	2	9.7314	9.9511	9.6725	0.2068	0.2470	0.4350	7136
30-39	0	3	9.9705	10.2737	10.0728	0.1453	0.1722	0.4387	2496
30-39	0	4	9.8907	10.1592	9.9148	0.0895	0.1089	0.3745	12976
30-39	0	5	9.8358	10.0924	9.8108	0.1033	0.1280	0.4404	31720
30-39	0	6	9.4969	9.6522	8.4386	0.1610	0.1945	0.7381	25672
30-39	1	2	9.7812	10.0082	9.7582	0.1733	0.2029	0.3885	24048
30-39	1	3	10.0676	10.3853	10.2350	0.1189	0.1487	0.3038	10864
30-39	1	4	9.9504	10.2334	10.0634	0.0993	0.1212	0.3067	57704
30-39	1	5	9.9023	10.1740	9.9638	0.0863	0.1044	0.3112	103992
30-39	1	6	9.5983	9.7940	8.9448	0.1561	0.1926	0.7217	44896
30-39	2	2	9.8966	10.1386	9.9510	0.1584	0.1841	0.2806	7016
30-39	2	3	10.1157	10.4417	10.3126	0.1169	0.1396	0.2821	15040
30-39	2	4	10.0500	10.3548	10.2223	0.0910	0.1108	0.2554	66704
30-39	2	5	9.9224	10.1959	9.9957	0.0847	0.1050	0.3140	11360
30-39	2	6	9.7614	9.9997	9.4653	0.1642	0.1995	0.6218	13544
30-39	3	2	10.0637	10.3443	10.1848	0.1445	0.1682	0.2692	2472
30-39	3	3	10.2213	10.5758	10.4733	0.1061	0.1257	0.2188	56776
30-39	3	4	10.1820	10.5218	10.4050	0.1020	0.1192	0.2366	14192
30-39	3	5	10.0281	10.3317	10.1556	0.0786	0.0942	0.2360	2160
30-39	3	6	9.8568	10.1243	9.6494	0.2910	0.3460	0.7401	8176
40-49	0	2	9.7944	10.0234	9.8090	0.2153	0.2479	0.4124	14904
40-49	0	3	10.1032	10.4281	10.2831	0.1483	0.1744	0.2832	3240
40-49	0	4	10.0333	10.3267	10.1409	0.0965	0.1144	0.4096	26408
40-49	0	5	9.9523	10.2293	9.9779	0.0888	0.1068	0.4132	52456
40-49	0	6	9.5291	9.6908	8.3987	0.1158	0.1385	0.6552	33504
40-49	1	2	9.8222	10.0564	9.8508	0.2017	0.2303	0.3874	26888
40-49	1	3	10.1353	10.4650	10.3172	0.1159	0.1378	0.3383	10240
40-49	1	4	10.0441	10.3414	10.1742	0.0924	0.1066	0.3397	63536
40-49	1	5	9.9722	10.2574	10.0452	0.0784	0.0913	0.3698	98424
40-49	1	6	9.5901	9.7805	8.7413	0.1359	0.1624	0.7258	45816
40-49	2	2	9.9428	10.1982	10.0439	0.2127	0.2395	0.3999	8296
40-49	2	3	10.2001	10.5426	10.4361	0.0998	0.1149	0.2242	14080
40-49	2	4	10.1177	10.4367	10.3154	0.0896	0.0998	0.2423	60760
40-49	2	5	9.9639	10.2458	10.0282	0.0927	0.1087	0.3368	6600
40-49	2	6	9.7340	9.9667	9.2030	0.1693	0.1967	0.7555	10688
40-49	3	2	10.0609	10.3468	10.2137	0.2176	0.2440	0.3268	3992
40-49	3	3	10.2823	10.6558	10.5651	0.0888	0.0968	0.2246	52616
40-49	3	4	10.2034	10.5497	10.4479	0.0936	0.1081	0.2432	10048
40-49	3	5	9.9575	10.2519	10.0141	0.1553	0.1899	0.4920	1336
40-49	3	6	9.7562	10.0064	9.2540	0.1988	0.2284	0.6097	6168
50-59	0	2	9.8187	10.0445	9.6083	0.2177	0.2507	0.6117	23104
50-59	0	3	10.1467	10.4706	9.9419	0.0769	0.0976	0.7348	4712
50-59	0	4	10.0229	10.3082	9.6755	0.0807	0.1000	0.7584	37280
50-59	0	5	9.9397	10.2103	9.5256	0.0721	0.0933	0.7692	67120
50-59	0	6	9.6423	9.8300	8.1882	0.0892	0.1060	0.6703	78048
50-59	1	2	9.8583	10.0903	9.6704	0.2249	0.2541	0.6149	18320
50-59	1	3	10.2053	10.5344	10.0487	0.0948	0.1183	0.7306	7656
50-59	1	4	10.0747	10.3702	9.8023	0.0835	0.1021	0.7519	42960
50-59	1	5	9.9806	10.2586	9.7001	0.0765	0.0963	0.7328	55904

50-59	1	6	9.6830	9.8860	8.3502	0.0936	0.1109	0.6987	49240
50-59	2	2	9.9765	10.2305	9.8916	0.2011	0.2132	0.5700	4992
50-59	2	3	10.2819	10.6257	10.0257	0.0751	0.0924	0.7907	12896
50-59	2	4	10.1953	10.5162	10.0422	0.0873	0.1045	0.7206	35480
50-59	2	5	10.0047	10.2889	9.8069	0.0807	0.0997	0.6779	3472
50-59	2	6	9.8710	10.1234	8.6574	0.1172	0.1310	0.7686	13296
50-59	3	2	10.1393	10.4192	10.1313	0.2093	0.2512	0.4870	3024
50-59	3	3	10.4058	10.7835	10.3949	0.0807	0.0978	0.6969	38312
50-59	3	4	10.2785	10.6247	10.2209	0.0948	0.1216	0.7501	6760
50-59	3	5	10.0415	10.3375	9.7431	0.1217	0.1550	0.8112	840
50-59	3	6	9.9273	10.1949	8.8261	0.1516	0.1748	0.7451	7672

Table A5. Actual mean log income and relative risk premia (with $\gamma = 3$) in the 2000–2008 panel data, by age (4 groups), education level (4 levels) and socio-economic status (5 classes) in 2000.

Age in 2000	Education level	socio-ec. status	Actual log Disp income	Gross income	Factor inc.	Risk premium Disp income	Gross income	Factor inc.	Obs.
20-29	0	2	9.8173	10.0657	9.8943	0.1736	0.2005	0.3425	2704
20-29	0	3	9.9910	10.2956	10.1571	0.1184	0.1405	0.3055	1424
20-29	0	4	9.9128	10.1881	10.0505	0.1001	0.1209	0.2749	8008
20-29	0	5	9.8758	10.1409	9.9790	0.0827	0.0997	0.2610	24728
20-29	0	6	9.6549	9.8649	9.4532	0.1169	0.1423	0.4194	27328
20-29	1	2	9.9582	10.2190	10.0801	0.1453	0.1699	0.2744	7760
20-29	1	3	10.1527	10.4826	10.4034	0.1183	0.1433	0.2364	12536
20-29	1	4	10.0376	10.3325	10.2365	0.1059	0.1272	0.2316	52920
20-29	1	5	9.9698	10.2497	10.1335	0.0834	0.0999	0.2111	100112
20-29	1	6	9.8837	10.1527	9.9806	0.1577	0.1929	0.3970	106464
20-29	2	2	10.0803	10.3530	10.2350	0.1526	0.1774	0.2672	1576
20-29	2	3	10.1362	10.4609	10.3824	0.0770	0.0917	0.1664	4656
20-29	2	4	10.0934	10.3980	10.3137	0.0681	0.0803	0.1518	26184
20-29	2	5	9.9965	10.2802	10.1681	0.0679	0.0801	0.1733	8304
20-29	2	6	9.9333	10.2118	10.0532	0.1194	0.1447	0.3360	9288
20-29	3	2	10.1295	10.4272	10.3148	0.1232	0.1417	0.2440	672
20-29	3	3	10.2876	10.6461	10.5802	0.0657	0.0764	0.1260	21440
20-29	3	4	10.2244	10.5627	10.4964	0.0661	0.0769	0.1333	13400
20-29	3	5	10.1420	10.4597	10.3787	0.0824	0.0971	0.1613	2304
20-29	3	6	10.0659	10.3726	10.2590	0.1219	0.1461	0.2818	7128
30-39	0	2	9.8646	10.1163	9.9752	0.1435	0.1642	0.2642	7136
30-39	0	3	10.0955	10.4336	10.3434	0.0882	0.1016	0.1874	2496
30-39	0	4	9.9650	10.2583	10.1443	0.0624	0.0726	0.1713	12976
30-39	0	5	9.8976	10.1725	10.0277	0.0583	0.0680	0.1843	31720
30-39	0	6	9.5914	9.7812	9.1902	0.0765	0.0903	0.3236	25672
30-39	1	2	9.8979	10.1538	10.0179	0.1195	0.1375	0.2268	24048
30-39	1	3	10.1573	10.5011	10.4222	0.0659	0.0767	0.1423	10864
30-39	1	4	10.0230	10.3268	10.2309	0.0565	0.0654	0.1347	57704
30-39	1	5	9.9555	10.2428	10.1212	0.0475	0.0550	0.1398	103992
30-39	1	6	9.7022	9.9344	9.5633	0.0815	0.0959	0.3189	44896
30-39	2	2	10.0170	10.2875	10.1815	0.1215	0.1398	0.2088	7016
30-39	2	3	10.1971	10.5447	10.4721	0.0589	0.0682	0.1236	15040
30-39	2	4	10.1207	10.4441	10.3658	0.0516	0.0595	0.1135	66704
30-39	2	5	9.9859	10.2779	10.1656	0.0528	0.0617	0.1445	11360
30-39	2	6	9.8711	10.1448	9.9216	0.0879	0.1035	0.2845	13544
30-39	3	2	10.2210	10.5389	10.4566	0.1138	0.1307	0.1925	2472
30-39	3	3	10.2942	10.6669	10.6029	0.0520	0.0593	0.1014	56776
30-39	3	4	10.2625	10.6235	10.5576	0.0547	0.0624	0.1110	14192
30-39	3	5	10.1121	10.4396	10.3480	0.0638	0.0738	0.1393	2160
30-39	3	6	10.0060	10.3168	10.1455	0.1086	0.1263	0.2818	8176
40-49	0	2	9.9506	10.2101	10.1015	0.1390	0.1538	0.2246	14904
40-49	0	3	10.2194	10.5712	10.4975	0.0762	0.0838	0.1476	3240
40-49	0	4	10.1090	10.4210	10.3280	0.0568	0.0630	0.1356	26408
40-49	0	5	10.0129	10.3067	10.1815	0.0475	0.0530	0.1511	52456
40-49	0	6	9.6259	9.8234	9.2048	0.0618	0.0701	0.2674	33504
40-49	1	2	9.9666	10.2295	10.1245	0.1307	0.1445	0.2144	26888
40-49	1	3	10.2333	10.5872	10.5184	0.0690	0.0758	0.1296	10240
40-49	1	4	10.1195	10.4335	10.3444	0.0552	0.0597	0.1229	63536
40-49	1	5	10.0302	10.3305	10.2193	0.0473	0.0521	0.1374	98424
40-49	1	6	9.6990	9.9256	9.4643	0.0735	0.0830	0.2933	45816
40-49	2	2	10.0950	10.3805	10.3043	0.1348	0.1495	0.2058	8296
40-49	2	3	10.2836	10.6435	10.5840	0.0591	0.0642	0.1054	14080
40-49	2	4	10.1935	10.5280	10.4575	0.0548	0.0586	0.1037	60760
40-49	2	5	10.0348	10.3350	10.2251	0.0574	0.0641	0.1502	6600
40-49	2	6	9.8740	10.1486	9.8530	0.0890	0.0992	0.2855	10688
40-49	3	2	10.2387	10.5602	10.4952	0.1447	0.1610	0.2103	3992
40-49	3	3	10.3612	10.7490	10.6960	0.0533	0.0567	0.0909	52616
40-49	3	4	10.2914	10.6567	10.6011	0.0560	0.0603	0.0986	10048
40-49	3	5	10.0920	10.4250	10.3240	0.0753	0.0860	0.1807	1336
40-49	3	6	9.9472	10.2504	9.9799	0.1103	0.1239	0.2968	6168
50-59	0	2	9.9796	10.2361	10.0267	0.1369	0.1514	0.2992	23104
50-59	0	3	10.2485	10.5987	10.3802	0.0596	0.0692	0.3140	4712
50-59	0	4	10.0979	10.4037	10.1153	0.0434	0.0522	0.3327	37280
50-59	0	5	9.9982	10.2860	9.9699	0.0411	0.0505	0.3479	67120
50-59	0	6	9.7316	9.9508	9.0221	0.0484	0.0549	0.2949	78048
50-59	1	2	10.0077	10.2691	10.0613	0.1271	0.1401	0.2856	18320
50-59	1	3	10.3014	10.6529	10.4440	0.0549	0.0641	0.2986	7656
50-59	1	4	10.1514	10.4656	10.2080	0.0448	0.0530	0.3109	42960

50-59	1	5	10.0379	10.3323	10.0676	0.0408	0.0487	0.2948	55904
50-59	1	6	9.7811	10.0157	9.1890	0.0504	0.0567	0.3082	49240
50-59	2	2	10.1485	10.4311	10.2493	0.1378	0.1491	0.2620	4992
50-59	2	3	10.3603	10.7199	10.4627	0.0440	0.0513	0.3344	12896
50-59	2	4	10.2732	10.6109	10.3983	0.0436	0.0504	0.2686	35480
50-59	2	5	10.0804	10.3861	10.1607	0.0568	0.0665	0.2769	3472
50-59	2	6	9.9889	10.2735	9.5163	0.0546	0.0602	0.3209	13296
50-59	3	2	10.3270	10.6413	10.4980	0.1286	0.1411	0.2321	3024
50-59	3	3	10.4838	10.8760	10.7020	0.0434	0.0485	0.2486	38312
50-59	3	4	10.3735	10.7400	10.5540	0.0497	0.0565	0.2555	6760
50-59	3	5	10.1561	10.4901	10.2486	0.0572	0.0676	0.2966	840
50-59	3	6	10.1002	10.4128	9.7241	0.0784	0.0868	0.3344	7672

Table A6. Descriptive statistics, shares in gross income in 2001-2008.

	2001-2008				
	Median	Mean	Std. Dev	Min	Max
Sickness/Health care	0.00462	0.00544	0.00322	0.00108	0.01363
Disability	0.01594	0.03746	0.05067	0.00292	0.24753
Old age	0.01539	0.03999	0.04892	0.00347	0.21442
Survivors	0.00367	0.00484	0.00415	0.00003	0.02135
Family/children	0.02770	0.02785	0.02057	0.00138	0.06385
Unemployment	0.02499	0.03734	0.03520	0.00578	0.15354
Housing	0.00287	0.00689	0.01045	0.00043	0.05697
Social exclusion	0.00199	0.00276	0.00280	0.00051	0.02050
Student	0.00132	0.00406	0.00780	0.00009	0.04508
Taxes	0.26187	0.25942	0.03215	0.17298	0.32445
Health insurance	0.01045	0.01153	0.00710	0.00183	0.03026
Obs. in cells	13348	25237.1	26565.3	672	106464
Number of cells	80				