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Changing family structure and income inequality in Finland 1990-2009 - a decomposition analysis

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ABSTRACT
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CHANGING FAMILY STRUCTURE AND INCOME INEQUALITY IN FINLAND 1990–2009

OBJECTIVES

This thesis examines how demographic shifts in population have affected distribution of income in Finland during 1990–2009. Attention is given to changes in family structure: increased number of couples without children, decreased number of couples with children, growth of households of one and aging of population.

DATA AND METHODOLOGY

Income distribution survey data from Statistics Finland for years 1990–2009 is used in the analysis. Inequality is measured for equivalent disposable income. Three indices from generalized entropy family are used as measures for inequality. Inequality is decomposed by population subgroups to describe inequality within household groups and between household groups. A decomposition of changes in inequality is used to study how much shifts in family structure account for changes in inequality. Inequality is also decomposed by income sources to describe relative roles of earned incomes, capital incomes, received transfers and taxes in comprising of inequality.

RESULTS

The results show that most of inequality is caused by inequality within household groups and a minor part is caused by differences between household groups. Changes in family and household structure have had a minor role for increase of income inequality. Changes in household structure have affected inequality increasingly but they caused only small proportion of total increase. Results of earlier research are confirmed about increased role of capital incomes as explaining overall inequality. The changes in upper part of income distribution have been important factor for changes in inequality.

Keywords: income inequality, income distribution, decomposition method, generalized entropy indices

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MUUTTUVA PERHE JA TULOEROT SUOMESSA 1990–2009

TAVOITTEET

Tämä tutkielma tarkastelee miten väestössä tapahtuneet muutokset ovat vaikuttaneet tulojakaumaan Suomessa vuosien 1990 ja 2009 välillä. Tarkastelu kohdistuu perheiden ja kotitalouksien muutoksiin: kasvaneeseen lapsettomien kahden aikuisen kotitalouksien määrään, laskeneeseen ydinperheiden määrään, kasvaneeseen yksinasuvien määrään sekä väestön ikääntymisen vaikutuksiin.

AINEISTO JA MENETELMÄT

Tutkimuksessa käytetään Tilastokeskuksen tulonjakotutkimuksia vuosilta 1990–2009. Tulonjaon eriarvoisuutta mitataan ekvivalenteilla käytettävissä olevilla tuloilla. Eriarvoisuuden mittarina käytetään kolmea yleistetyn entropiamitan perheeseen kuuluvaa indeksiä. Tutkimuksen pääasiallinen metodi on tulonjaon eriarvoisuutta mittaavien indeksien hajotelmat. Indeksit hajotetaan tulonsaajaryhmien mukaan ryhmien sisäiseen ja ryhmien väliseen eriarvoisuuteen. Tuloerojen muutoksien hajotelmaa käytetään väestörakenteen muutoksien tulonjakovaikutusten arviointiin. Tulonjakoa mittaavat indeksit hajotetaan myös tulonlähteiden mukaan. Näin saadaan tietoa ansiotulojen, pääomatulojen, saatujen tulonsiirtojen sekä verojen vaikutuksesta tuloerojen muodostumisessa.

TULOKSET

Tulokset osoittavat kotitalouksien välisten tuloerojen muodostavan vain pienen osan tuloeroista, joista suurin osa muodostuu kotitalouksien sisäisestä eriarvoisuudesta. Kotitalouksien rakenteen muutokset ovat olleet vähäisessä roolissa tuloerojen kasvun tekijänä. Muutokset kotitalouksien rakenteessa ovat lisänneet käytettävissä olevilla tuloilla mitattua eriarvoisuutta, mutta vaikutus on ollut verrattain pieni kun tarkastellaan tuloerojen kokonaismuutoksia. Aiempien tutkimusten tulokset pääomatulojen kasvun merkityksestä tuloerojen lisääjänä vahvistuvat tässä tutkimuksessa. Samoin suurissa tuloissa tapahtuneet muutokset korostuvat tuloerojen muutoksissa.

Avainsanoja: tulonjako, tulojakauma, hajotelmamenetelmä, yleistetyt entropiamitat

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1. Introduction

Income inequality has seen spurts of increases from the second half of 1990s in Finland. This was after a long trend starting from the mid 1960s of economic inequality leveling off which was seen as Finland becoming a Scandinavian welfare state. At the same time that we have seen the new dispersion of incomes, there have been changes in the structures of Finnish families. Average family size has decreased, the number of single households has increased, more and more couples live without having children, population is aging and youngsters move alone to live without their parents earlier than they used to a couple of decades ago. These changes have led to a new structure of household, which nowadays more rarely than before comprises of a nuclear family of two adults and children.

Reasons for increased inequality have been sought from increased wage dispersion caused by technology change, role of government as a redistributor and changes in demographic features of population, among others. Changes in household structure towards more relatively poor single households and relatively well-doing couple households are likely to inequalize income distribution.

The purpose of this study is to bring further light into the discussion of the structure of inequality and to give insights into what are causes of changes in inequality that we see in indices. Changes in family characteristics and their effect on income distribution have not been much researched in Finland. However, the changes in the structure of families in the past decades are likely to cause changes in the income distribution. This is because in addition to one's personal income, both the household structure and household income matter when we look at the economic well-being of individuals. Calculating individual incomes consisting of personal incomes less tax would leave dependent persons without own incomes (such as children) to be poor even if they would live in wealthy households. On the other hand, if only household incomes per capita were taken into account, economies of scale and characteristics of family would be neglected.

Thus analysis of income inequality usually takes household incomes and structure into account by accounting incomes that are equivalent to household size and structure. Income distribution changes if the household structure changes, everything else being equal. Larger

families have more economies of scale in consumption than smaller families on one hand and on the other hand, incomes are shared in at least to some extent between all the members of a household. Living in a family is a means to reduce income risks – it serves as a kind of insurance to members of family.

In this thesis I study whether the changes in the structure of households have had an influence on income inequality changes and if so, how large an influence have they had. The analysis is based on empirical investigation, taking advantage of a subgroup decomposition method by which inequality is decomposed into inequality within household groups and inequality between household groups. Inequality indices used in this study are members of generalized entropy family of indices. The trends of inequality are also decomposed into parts such that effects of changes in demographic features of population can be assessed in relation to total inequality.

The research reveals that most of inequality is explained by income differences within household groups and only a minor part of inequality is explained by differences between household groups. The relative role of differences between household groups has decreased from 1990 to 2009. Changes in household composition have had a minor but nonetheless increasing effect on overall changes in inequality throughout the whole time period under study. Their relative importance has varied: during time of high inequality increase in 1995–2000, the relative contribution was small, explaining less than tenth of increased inequality, whereas during time of lower inequality increase the relative contribution was larger, explaining almost a third of inequality increase.

In addition to analyzing household composition changes, a decomposition method for income sources is taken advantage of. There the disposable income is divided into its components – earned income, capital income, received transfers and taxes – to look at their roles in making up total inequality. Income source decompositions confirm results of earlier studies that role of capital income has increased when it comes to inequality. These incomes are heavily concentrated, although not on certain household groups. Capital incomes took especially strong role in the forming of inequality in 2000 and 2007, when the economy as well as inequality saw high peaks.

The structure of the paper is as follows. First I go through basic concepts and measurement issues concerning inequality studies, going through the problems of which measure for economic welfare to use and how to take into account household characteristics and economies of scale in different types of households. I'll also discuss about common inequality measures as well as their properties. Explanations for inequality are briefly discussed before description of decomposition method. Third chapter gives a literature review about research of demographic changes' effects on income inequality and a brief review of literature about Finnish income inequality.

Fourth chapter describes data. Fifth chapter describes household composition changes in Finland during couple of last decades as well as summarizes mean incomes of different household groups. After descriptive analysis the results of decompositions by household groups as well as decomposition of trends in inequality are presented. The chapter also contains analysis of contributions of different income components on inequality. The reasons for changes in family composition are also discussed briefly. Finally, the sixth chapter discusses the analysis and gives conclusions.

2. Income inequality and measurement

Why one should be concerned of economic inequality is a question for which at least two types of answers have been provided. Income inequality is both a matter of ethical and philosophical view of justice and a factor affecting the economic state and development of a country. Recent views presented from the point of view of justice are concerned with equality of opportunities (see Roemer 1998). The view emphasizes that everyone should have possibilities for gaining same outcomes despite of circumstances people are born to. The outcome would only depend on individual choices and efforts. The connection between economic growth and inequality has been debated in literature with controversial views of the impact of inequality to growth (see for example Barro 2000, Aghion et al. 1999 and Persson and Tabellini 1994). Inequality might act as an incentive for economic actors, thus increasing economic growth, but empirical research seems to find no consensus on the relationship of the two.

Recently there has been a lot of discussion about welfare measurement. GDP has been a traditional but restricted measure for welfare. Stiglitz, Sen and Fitoussi's report (2009) about measurement of welfare states that a range of measures should be used to account for well-being. They recommend inequality of income, consumption and wealth to be accounted as one dimension of welfare along with measures such as health and education. Welfare measured by indices taking into account other variables along with GDP may give different views about well-being than mere GDP. For example, United Nations Development Program has computed a Human Development Index (HDI) from 1990 to measure development of countries. The index derives different rankings than GDP does. Jones and Klenow (2010) comprise a welfare index of life expectancy (as an indicator of health), consumption, leisure and inequality. They make a comparison across countries with their index and find that welfare in Western Europe is much closer to that in the United States and on the other hand many African and Latin American countries are further away from U.S. than GDP per capita indicates. Inequality is and should be used as an important dimension of welfare.

2.1. Income distribution: concepts and measurement

Important concepts concerning this study are presented in this part. These include the measurement of economic welfare and taking into account the size and characteristics of households when studying individual incomes. This chapter also presents the most common inequality indices and concentrates on the properties of the general entropy family of inequality indices to be used in this study.

2.1.1. Economic welfare

Which measure for economic welfare of individuals should be used in a study concerned about economic inequality is not as simple question as it might first look like. An indicator that should be of interest is welfare of human beings. However, actual welfare or utility of each person is not easily observed or measured, and thus income is a natural proxy for economic welfare. The income measure is not without problems either. We can measure one's income at a certain point in time, let's say year 2011, but it tells us only about the income of that year but not about possible savings and wealth that person has accumulated over years.

People are supposed to divide their consumption over years through savings. Many studies therefore use the concept of consumption since that measure compared to income reveals more about the possibilities to consume and it is independent on person's income at the moment. On the other hand, inequality may be considered to be about differences in resources rather than how one actually uses income or does not use it. Individuals also differ in their consumption preferences. Therefore using income as a measure rather than consumption lets us focus on economic well-being independent of consumption choices of individuals. Life-cycle income would be the most preferable measure for income inequality because it gives budget constraints over lifetime for consumption. There is no data, however, for life-cycle income.

This paper considers incomes as an indicator for economic well-being instead of consumption. This is a fairly common practice in most studies of income inequality in developed countries, also somewhat due to data availability. Income statistics are mainly registered data whereas consumption data is based on surveys which are prone to biases.

Thus income data often gives more reliable information than consumption data[1]. In Finland, there is yearly income data available whereas consumption data is collected with about a 5-year interval. At the time of writing, newest income data is for year 2009, whereas newest consumption data is for 2006. Finnish economy along with many others experienced economic downturn beginning from 2007, the results of which are interesting to take in the study from the point of view of inequality. This aspect also favors the use of income data instead of consumption data.

Concerning incomes, one could be interested in labour income or capital income of individuals but the income concept that is usually of interest in income distribution studies is disposable income. It is formed in the following way:

	Factor income
+	Transfers to households
=	Gross income
−	Direct taxes and other transfers paid by households
=	Disposable income

Factor income includes labour income, entrepreneurial income and capital income. Transfers to households include social benefits, pensions, unemployment benefits and other government transfers. Finally, disposable income is received by taking the taxes that households pay from their income. Thus disposable income is the amount that households have in the end for their consumption after received and paid transfers.

This income concept could be further developed to take into account indirect taxes paid (comprised mostly of the value added taxes), the values of in-kind services individuals receive (such as free schooling or health care services in Finland), the value of home production or unrealized capital gains. These components, especially the last two mentioned, are difficult to measure and are usually not taken into account due to lack of data although they may affect the shape of income distribution (Brandolini and Smeeding 2009). For example, the value of in-kind services compared to disposable income was very

[1] This is true at least in developed countries with good registration data. In developing country context, consumption is often more reliable indicator of economic welfare as the income data is poor and difficult to gather (Deaton and Zaidi 2002).

high in Finland in 2000, almost 30 per cent of the value of household disposable income (OECD 2008, pp.233) and thus affect income distribution depending on the usage of these services in different groups of population. This paper, however, neglects these components because of data limitations.

2.1.2. Equivalent incomes and equivalence scales

In addition to choosing whether to use income or consumption as a measure for economic welfare we must choose which income recipient unit to use. Income inequality measurement usually studies incomes of individuals and how they are divided. Another typical choice is incomes of families or households. The evaluations of the degree of inequality may vary depending on the choice of income-receiving unit (Atkinson and Bourguignon 2000). Household characteristics of each individual differ and have relevance for the well-being of individuals. Living in a family is a means to sharing expenses and having advantage from economies of scale in consumption. A family of three, for example, needs only one kitchen with one oven, one refrigerator, and so one, which they can share, whereas a single person living on his/her own needs all the same equipment to be as well off as the family.

This study is concerned of equivalent incomes which measure individual incomes but also take into account family characteristics. Household incomes are divided with an equivalence factor to gain individual income. One benefits from living with others and thus equivalence factor is smaller than number of members in a household. An equivalent income of an individual living with another person, both having an income of let's say 20'000 euros, is larger than an equivalent income of a person living alone with an income of 20'000 euros.

Equivalence scales are usually calculated by giving some weights to each member of a household; for example, in the modified OECD scale one gives weight 1 to the first adult person in a household and a weight 0.5 to the second adult person in a household, thus assuming that to be as well off, a household of two adults should earn 1.5 times as much as a household of one adult (instead of 2 times as much if we assume no economies of scale). One should note that the method of calculating equivalent incomes assumes that incomes

within a household are shared and income inequality inside household is thus neglected.

Because of scale economies and the income sharing assumption, changes in household characteristics affect the income distribution of individuals measured in terms of equivalent incomes. In a single-parent family there is only one income-receiving adult whereas in two-parent families there is the income of two persons that can be divided with the family. Single adult households on the other hand can't benefit from scale economies as for example two-adult households can and thus an increase of single person households could put pressure on the lower parts of income distribution. Less income pooling and advantages from economies of scale in general are likely to cause disequalizing effect on the distribution.

The choice of equivalence scales is an important factor, since it straightforwardly affects the amount of estimated equivalent incomes. There are some common practices for using certain equivalence scales, but no single one has been stated as the best indicator taking into account all matters of family size and characteristics. The amount of the economic benefits that come from living with others is not very clear cut and thus the choice of the equivalence scale is somewhat arbitrary.

For a discussion of different equivalence scale usages and testing their effect on measures of income inequality, see for example Buhmann et al. (1988). Usually the choice of equivalence scale does not affect trends in inequality, although it may affect income rankings of different groups in population. When we look at households, an equivalence scale which assumes more scale economies affects such that incomes of larger households become relatively larger in comparison to using an equivalence scale assuming less scale economies.

2.1.3. Measurement of income inequality

Individuals differ in their capabilities and efforts and are driven by incentives. An optimal or fair amount of inequality is thus not zero. Differing income distributions are evaluated based on welfare of whole society. Atkinson (1970) gave theoretical basis to welfare comparisons of income distributions. His work along with Shorrocks' (1983) has given foundation to inequality measurement of today.

There are several indices that describe economic inequality in a given population, usually interested in dispersion measures of the income distribution. In literature the properties of a good measure are usually stated to satisfy at least some basic principles. This study assumes a good inequality measure to satisfy at least the following principles: anonymity principle, population principle, and the Pigou-Dalton principle (Jenkins and Van Kerm 2009, Cowell 2000).

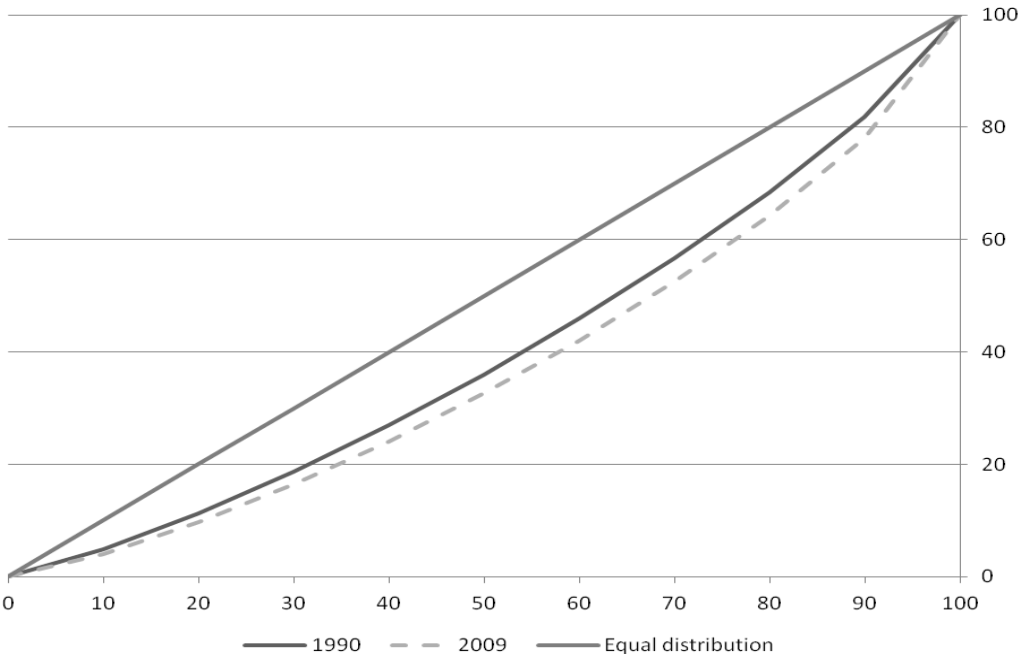
Suppose we have an income distribution (y_1, y_2, …, y_n), where y_1 is the income of individual 1, y_2 is the income of individual 2 and so on. Anonymity principle means that it does not matter who earns the higher or the lower income. Other qualities of a person are irrelevant and income is the only quality that matters for the inequality measure. Thus we can always arrange the income distribution equivalently to how we would arrange individuals in order from the poorest to the richest in the following way: $y_1 \leq y_2 \leq ... \leq y_n$.

The population principle states that it does not matter in absolute terms how many people we have in a population, only relative amounts of people in different parts of distribution matter. Thus we can multiply a population with a certain income distribution (y_1, y_2,…, y_n) and the measure of inequality does not change. The Pigou-Dalton principle (also called the principle of transfers) states that if we have an income distribution (y_1, y_2, …, y_n) in which $y_i \leq y_j$, then every transfer from the poorer person to the richer increases the value of inequality measure and vice versa, as long as the transfer from rich to poor does not reverse their positions.

Relative income principle is also usually assumed for a good measure to have. It states that it does not matter in absolute terms how much income everyone receives, but only the relative amounts matter. Thus if we multiply everyone's income in an income distribution by the same scalar, the amount of inequality does not change. This property may raise some controversial views; are the income distributions with absolutely differing incomes with the same relative inequality as good or as bad? Is doubling or tripling everyone's incomes irrelevant in a society? In terms of this property, it is: only the relative inequality matters. In the thesis we are interested on the inequality and not on levels of income per se.

One of the most well-known indicators of income inequality is Lorenz curve which plots the proportion of income that a certain proportion of population receives. The Lorenz curves for Finland in the years 1990 and 2009 are depicted in figure 1. The curves are measured for disposable income. The x-axis shows the proportion of people in the population ordered by their incomes such that the ones earning the least are on the furthest left while the ones earning the most are on the furthest right. On the y-axis one can see the proportion of income earned by population. The 45-degree line shows a perfectly equal distribution. The further the Lorenz curve is from the 45-degree line, the more unequal is the distribution. (Lambert 1993) As can be seen, the Lorenz curve for Finland has become more unequal from 1990 to 2009 since the Lorenz curve for year 2009 is further away from the 45-degree line than the Lorenz curve for year 1990.

Figure 1: Lorenz curves of equivalent disposable income for 1990 and 2009 and equal distribution line of 45 degrees.



Source: authors own calculations from Income Distribution Surveys of 1990 and 2009 by Statistics Finland

If two Lorenz curves crossed, it wouldn't be straightforward to say which distribution is more equal. If, for example, the curves in figure 1 would cross at x-value 50, such that the Lorenz curve for 2009 would be closer to perfect equality line for half (less earning) population compared to 1990, then for that part of population inequality would have decreased, but for the other part inequality would have increased.

There are many indices that try to depict the amount of inequality in one number. That way, two distributions can be compared such that one can always say that other distribution is less equal than other, even if Lorenz curves would cross. One of the most widely used of those inequality measures is Gini coefficient which fulfills all the properties of a good index stated above. It can also be neatly related to the Lorenz curve. Gini coefficient can be calculated as the ratio of the surface between the Lorenz curve and the 45-degree line to the area of the triangle below the 45-degree line of perfect equality, or formally as:

$$G = 1 - 2\int_0^1 L(p)dp$$

, where L(p) is the Lorenz curve. The larger the surface is in proportion to the triangle area, the further away from the 45-degree line we are at the Lorenz diagram, and the higher is the inequality and the higher the Gini coefficient.

Some indices used in income inequality studies describe the amount of poor people, by defining some threshold value for being poor. This value can be, for example 60 per cent of the median income. There are also indices that describe the ratio between incomes of population in different parts of the distribution, such as p90/p10 ratio, p50/p10 ratio etc. For example the first mentioned describes the ratio of lower bound income of 10 per cent of population with the highest incomes to upper bound income of 10 per cent of population with the lowest incomes.

The Gini coefficient and the ratio indices give intuitive values for income inequality. Other indices, however, are useful when one wants to describe inequality between and within certain population subgroups, for example different age groups or sexes. In addition to the desired principles stated earlier for inequality measures we could add a quality of decomposability. This means that we can decompose the inequality measure either by subgroups in the population or by income sources. Decomposing inequality index by income sources gives us knowledge of how different types of incomes such as labour income, capital income or pensions affect overall income inequality. Decomposing index by population subgroups is useful when one wants to study inequality within and between these groups or the effects of changes in the groups.

Indices of generalized entropy family are additively decomposable by population subgroups. The requirement of additive decomposability means that if we have mutually exclusive groups in a population then we can calculate the inequality within and between these groups and the sum of these amounts equals the total inequality in the population. Inequality is thus a sum of weighted inequalities within each population subgroup and the inequality between the population subgroups. For example the Gini coefficient could be decomposed by income sources (Lerman and Yitzhaki 1985), but it is not additively decomposable by population subgroups[2].

Shorrocks (1984) shows that members of generalized entropy (GE) family of indices are the only indices that can be naturally decomposed. These indices have properties that satisfy the anonymity principle, population principle, relative income principle and the Pigou-Dalton principle. The indices can be formalized as:

$$I_c = \frac{1}{Nc(c-1)} \sum [(y_i / \mu)^c - 1)] \qquad , c \neq 0, 1 \qquad (1)$$

$$I_o = \frac{1}{N} \sum_i \log(\frac{\mu}{y_i}) \qquad , c=0 \qquad (2)$$

$$I_1 = \frac{1}{N} \sum_i \frac{y_i}{\mu} \log \frac{y_i}{\mu} \qquad , c=1 \qquad (3)$$

In (1), (2) and (3) y_i is the income of i^{th} person in a population, N denotes the population, and μ is the mean income of population, $\sum_{i=1}^{n} y_i / N$. The parameter c in the equations refers to inequality aversion for different parts of the distribution. Replacing c with different values gives emphasis on different parts of distribution. The lower values c gets, the more the index emphasizes changes affecting lower parts of distribution, whereas higher values for c emphasize changes affecting higher parts of distribution (Cowell 2000). The choice of c corresponds to weights that are desired from an index and thus reflects the inequality aversion for different parts of distribution. In literature the most common choices of the GE indices are mean logarithmic deviation (MLD) (2), Theil index (3) and half the squared

[2] Suoniemi (2000) represents a method for decomposing the Gini coefficient by population subgroups, however with other criteria than that of Shorrocks' (1984) which is discussed next.

coefficient of variation[3]. These indices assign values 0, 1 and 2 to parameter c, accordingly.

Giving the parameter c the value 0 gives more emphasis on the lower parts of the distribution compared to higher values for c. Thus it reacts more to the changes in the low incomes. Theil index is neutral to all parts of the distribution: it does not give emphasis on any particular part of the distribution. Half the squared coefficient of variation with parameter value 2 gives emphasis on the higher parts of the distribution, reacting more on the changes in high incomes, compared to MLD or Theil index.

Mean logarithmic deviation simply calculates the sum of logarithmic differences of population mean income to each individual's income, divided by the number of population. Theil index calculates average of the sum of logarithmic differences of each individual's incomes to the population mean, weighted by the relative values of individual's income compared to population mean.

The values for mean logarithmic deviation and Theil index cannot by definition be calculated if there are zero or negative values for y_i. This does not hinder our analysis of disposable income since practically everyone's disposable income is positive. However, as in fifth chapter, when we want to analyze income components such as capital income which includes zero observations in a population, we have to use indices of the generalized entropy family other than mean logarithmic deviation or Theil index. The usual choice in literature is half the squared coefficient of variation which can be written from the general equation as:

$$I_2 = \frac{1}{2N}\sum_i \left[\left(\frac{y_i}{\mu} \right)^2 - 1 \right] = \frac{\sigma^2}{2\mu^2} \qquad (4).$$

General entropy indices are used in this study because of their decomposition property. Comparing these indices with different values for parameter c also gives possibilities to interpret the indices in terms of different parts of distribution. It is possible to evaluate where in a distribution incomes have dispersed most.

[3] Variation does not fulfill the relative income principle. The coefficient of variation is a scale-invariant (fulfills the relative income principle) version of variation, calculated as standard deviation divided by mean income

2.2. Causes of income inequality

The question of what causes income inequality is many folded and cannot be put in a single cause. One must look at different aspects to get an overall view to inequality. For example OECD (2008) points out three factors that could have been driving inequalities in the recent past: dispersion of earnings, the role of government as redistributor and changes in demography and living arrangements.

Different income sources and how those are divided between different parts of population are one important factor. As labour income is one of the largest income components of most households, it's a good starting point for analyzing income distribution. There are differences in the preferences of population for the division of work and leisure which can also explain some part of the diversification of incomes. Preferences lead some people to work more and others to work less and the incomes vary accordingly.

If wages of different types of workers disperse, it will cause labour income dispersion. The globalizing environment and the technological changes in the economies of western countries have driven the wages of high skilled labour up while the wages of lower skilled labour has stayed at a lower level (OECD 2011). There are, however, controversial views whether these changes have affected the overall changes in inequality or how large is their contribution. Atkinson (2000) for example criticizes views that explain inequality increase by unfavorable demand shifts for low-skilled labour. For example in Finland, the relative role of labour earnings as a cause of inequality has decreased in 1990s and 2000s and has been seen to be a minor cause of inequality increase (Riihelä et al. 2008). On the other hand, capital income's role has enlarged.

Government plays a major role as a redistributor of factor income through choices of taxation and transfers to households. Government transfers have an effect of equalizing the distribution of income by collecting taxes and redistributing incomes by different kinds of social security payments, and by offering various services such as schooling and health care. The overall redistributive effect of taxes and transfers may be measured by difference in Gini coefficients for factor income and disposable income. OECD (2011) shows that Nordic countries out of OECD countries gain highest reductions in factor inequality by

taxes and transfers. The tax-benefit system offset more than 75% of inequality increase from mid 1980s to mid 1990s in Finland. The offsetting power of tax-benefit system has declined since, to 50% in 2004.

Demographic features affect income distribution through the relative incomes and relative population shares of different groups in the society. The change in household structure towards more single households and lower average family size is likely to cause disequalizing effect on income distribution since there is on average less economies of scale and less income pooling. The increase of young single households with typically low incomes is likely to put pressure on the lower part of the distribution and thus widen inequality. The aging of population may also affect the distribution through increased amount of elderly single households since they have typically lower incomes than average. A way to find out the contribution of demographic trends is to take advantage of decomposition method which is explained in the following.

2.3. Decomposition method

There are two types of methods used in literature for calculating the effects of demographic changes or other structural changes of population to income inequality. The first one used is shift-share analysis and the second one is decomposition method. Shift-share analysis is based on comparing two income distributions such that one takes characteristics of one distribution and looks at how inequality would have changed if the characteristics would have prevailed in the other distribution. The real state of inequality is compared to the hypothetical situation where inequality is calculated by setting some factor causing inequality to correspond to the one that prevailed at another point in time while other factors stay unaffected.

For example, one could take the family structure characteristics of an income distribution in year 2009 and test the amount of inequality with those characteristics in 1990. The difference between the estimated and the observed inequality would be the effect caused by changes in family structure. The method assumes that the shift in family structure would not affect amounts of inequality within household groups or differences in average incomes between household groups.

Shift-share method has been criticized for its conditional nature. When there are multiple changes taking place at the same time, the shift-share analysis is not as good in detecting contributions of each change as decomposition method is. The partial effects in the shift-share analysis don't necessarily sum up to the overall inequality. Here I will go through the subgroup decomposition methodology used in the later analysis. The text follows Mookherjee and Shorrocks (1982).

Let's have n denoting population, μ mean income, and y_i income of unit i. The population n may be partitioned into mutually exclusive subgroups K such that k^{th} group includes n_k members and group mean income is μ_k. We denote population share by $v_k = n_k / n$ and group k's mean income relative to the population mean by $\lambda_k = \mu_k / \mu$.

Let's look at the mean logarithmic deviation I_0 (2), Theil index I_1 (3) and half the squared coefficient of variation I_2 (4). They can be written as sum of two terms:

$$I_0 = \sum_k v_k I_{0k} + \sum_k v_k \ln(1/\lambda_k) \quad (5)$$

$$I_1 = \sum_k v_k \lambda_k I_{1k} + \sum_k v_k \lambda_k \ln(\lambda_k) \quad (6)$$

$$I_2 = \sum_k v_k (\lambda_k)^2 I_{2k} + \frac{1}{2}\sum_k v_k [(\lambda_k)^2 - 1] \quad (7)$$

In (5), (6) and (7) the first terms represent the within-group component, calculated as a sum of weighted inequalities within each population subgroup. The second term represents the between-group component, or putting it another way, the amount of inequality that would prevail if in each subgroup, everyone's income would equal the mean income of that group. Thus it is the inequality between subgroups.

I_{ck} denotes inequality within k^{th} subgroup, measured by I_c. The population shares of groups, relative mean incomes of the groups compared to population mean and inequality within groups are components that define the amount and structure of inequality. These

components give information of whether the differences of groups define most of inequality or whether inequality comprises more of inequalities within groups.

These equations, however, do not yet give information about contributions of changes in demographic features to trends in inequality. Changes in mean logarithmic deviation can be expressed in a form that differentiates contributions of within group inequality as well as effect of changes in the population shares of groups and the influence of changes in each group's relative incomes. As in Mookherjee and Shorrocks (1982) the change between two years in I_0 can be written as

$$\Delta I_0 \equiv I_0(t+1) - I_0(t) = \sum_k \bar{v}_k \Delta I_{0k} + \sum_k \bar{I}_{0k} \Delta v_k - \sum_k \overline{[\log(\lambda_k)]} \Delta v_k - \sum_k \bar{v}_k \Delta \log(\lambda_k) \qquad (8)$$

$$\approx \sum_k \bar{v}_k \Delta I_{0k} + \sum_k \bar{I}_{0k} \Delta v_k + \sum_k [\bar{\lambda}_k - \overline{\log(\lambda_k)}] \Delta v_k + \sum_k (\bar{\theta}_k - \bar{v}_k) \Delta \log(\mu_k)\,. \qquad (9)$$

Here the lower equation is an approximation of the former. Let's describe each term in equation (9) with A, B, C and D as following:

$$\sum_k \bar{v}_k \Delta I_{0k} \qquad \text{Term A}$$

$$+\sum_k \bar{I}_{0k} \Delta v_k \qquad \text{Term B}$$

$$+\sum_k [\bar{\lambda}_k - \overline{\log(\lambda_k)}] \Delta v_k \qquad \text{Term C}$$

$$+\sum_k (\bar{\theta}_k - \bar{v}_k) \Delta \log(\mu_k) \qquad \text{Term D}$$

In the equation $\theta_k = v_k \lambda_k$ and a bar over variable indicates an average of base and current period values, for example $\bar{v}_k = [v_k(t) + v_k(t+1)]/2$. The approximation, according to Mookherjee and Shorrocks (1982) is sufficient and more useful in giving information about the effects of changes in the numbers and relative incomes in different groups than an exact decomposition.

Changes in inequality can be explained by pure inequality changes within groups, changes

in the numbers in different groups and changes in relative incomes of groups. These contributions are described by terms A, B, C and D. The pure inequality (term A) sums the changes in inequalities within the groups, weighted by the groups' population shares. Terms B and C capture the contribution of changes in numbers in different groups (terms B and C).

The terms B and C are mostly of interest in the study since we want to know to what extent the changes in the numbers in different groups have affected the overall inequality. The term B reflects the inequality changes within the groups due to changes in the population. If the population that shifts into a certain group has incomes concentrated either lower or higher compared to the incomes of the prior members it would affect the inequality within the group. Same is true if the population leaving from a certain group is concentrated higher or lower in incomes relative to the ones that are left in the group. The term C on the other hand reflects the inequality changes between the groups. If the shifts in the population lead to aggravate the inequalities between the groups, it is shown in term C as a positive number. Term D sums the influence of the changes in the relative incomes in different groups.

3. Literature review

The age structure in most western countries shows similar patterns as in Finland: the proportion of elderly people is increasing and people live longer than before. Many western countries have experienced decreasing family sizes, young people moving earlier on their own than before and proportion of nuclear families (families with two adults and children) have decreased in many countries compared to the proportion of all families. This part of the thesis focuses on research from other countries about demographic changes and their effect on income distributions.

3.1. Changing family structure as a cause to inequality

Studies of the influences of demographic changes on distribution of income can be found from several western countries. There has not been, however, much research about how these changes have affected the income distribution in Finland. In this section, I describe the research, the methods used and results gained about the contribution of changes in family characteristics to income distribution in other western countries, before going on to the analysis with Finnish data.

A comprehensive overview of all OECD countries is provided in OECD (2008). There the effects of demographic trends are assessed with a shift-share analysis, looking at the changes in Gini coefficient. The specific features under research are age structure and household structure, from which the latter is found to be more important factor in explaining inequality changes. The report finds large contributions – over 20% of inequality change caused by demographic features – for some countries, for example France, Netherlands and Canada (time periods 1984–2000, 1985–1999, 1985–2005). For Finland the combined effect of age structure and household structure are reported to account for over 16 per cent of the overall change in inequality for period of 1986–2004. The average effect of all countries is 11 per cent for varying time periods ranging from 1980 to 2005.

Many articles from the United States find that demographic changes have had a significant influence on inequality increase. For example, increase of single-parent families have affected with a notable proportion to an increase in inequality. Karoly and Burtless (1995),

Lerman (1996), Burtless (1999), Daly and Valletta (2006) and Martin (2006) study demographic changes and their effects on income distribution with differing time periods from 1959 to 2000 in the U.S. They all conclude that family composition changes had a notable influence on income distribution, although varying between time periods. Karoly and Burtless find that nearly half of inequality increase is caused by family characteristics change in the 1970s. The same is found by Lerman for 1970s and 1980s. Both studies give attention to rise of one-parent families. In addition to income inequality, Lerman was also interested in how family composition changes affected child poverty. Lerman found they had even more impact on child poverty than they did on income inequality.

Burtless (1999) finds that one-fifth to one-quarter of the change in inequality can be traced to changing family composition during time period from 1979 to 1996. Results of Daly and Valletta imply a significant contribution for family composition but less so in later period of 1989–1998 than earlier in 1969–1989. Martin finds similar results with contributions varying from 25 to 37 percentages of total in second half of 1970s and in 1980s and contributions less than a tenth after beginning of 1990s. The changes in family composition accounted for more of the inequality changes during 1970s and 1980s than it did in 1990s in the U.S.

Karoly and Burtless (1995) and Burtless (1999) also study the effect of growing wage disparities on inequality. There had been a large increase in earnings inequality in the U.S. starting from early 1970s, especially among the earnings of men. Both studies note a relation of family formation and earnings inequality: Karoly and Burtless find a significant contribution for the correlation between women's earnings and family income – the increased earnings of women were concentrated on those families with higher male earnings. On the other hand, Burtless finds that the increased inequality had been reinforced by changing marriage patterns: the men in the bottom quintiles of income distribution married less often than before, and the men in the top two quintiles on the other hand married more than before, and they married to women whose earnings increased more than the earnings of women who were married with men in the lower quintiles.

The findings of Karoly and Burtless (1995) and Burtless (1999) reflect a family formation pattern called assortative mating, meaning that individuals marry within or near their

income group. These kinds of trends in pair formation affect income distribution since if people tend to marry within their income groups, the overall family incomes get more dispersed. The trends of assortative mating are recently discussed in OECD (2011), where it is noted that phenomenon increased in nearly all OECD countries from mid 1980s to mid 2000s (although for Finland, it is found to have decreased if 10 percent of top income earners are excluded from the analysis).

Lu et al. (2011) recently studied earnings inequality, family composition and inequality in Canada, showing that the change in family composition would have caused about 20 percent or less of increased inequality in 1980–1995 and would have had even larger, about 30 percent contribution in more recent period 1995–2005. Lu et al. use four different income share ratios (p99/50, p90/50, p90/10 and p50/10) and Gini coefficient, finding that the family composition changes affected more on p90/10 and p50/10 ratios than on the other ratios or Gini coefficient. These indices give ratios of lower bound value of the best earning 10 percent of population to the upper bound value of least earning 10 percent and the ratio of median income to the upper bound value of least earning 10 percent. The results suggest thus that the family composition changes had larger effect on lower parts of distribution. Lu et al. find a declining trend for assortative mating from 1995 to 2005 and an equalizing effect due to the decline. They assess that this decline in assortative mating could be because of educated women outnumbering the educated men, leading to more educated women marrying outside (and below) their income group.

Studies from the U.S. give much attention to single-mother families and rise in their numbers. Martin (2006) differentiates the women that have been married before or that are widowed and those who have never been married. Martin finds that the rising amount of never-married women has had an effect on increased inequality and thus the family formation patterns are an important factor when it comes to inequality. The never-married single-mothers were earning less than average and they were also the most unequal group of all the household groups in Martin's analysis. Daly and Valletta also differentiate these two types of single-parents, but since their calculations are based on different method than that of Martin's they can't conclude anything about the differences in the two types of single-parent households.

Even though the changes in family composition seem to contribute a significant amount in inequality, Martin notes that there are large differences when comparing different sub-periods. The change in family structure had relatively larger effect during periods when inequality growth was smaller and relatively smaller effect when inequality growth was larger. This was even though during times of high inequality increase, the absolute contribution of family characteristics was higher than during times of lower inequality increases. This suggests that there were other, larger forces driving the inequality increase in the United States during the time of high inequality increase.

The method Martin uses is decomposition by subgroups, whereas other U.S. studies use shift-share analysis or similar (Lerman 1996, Burtless 1999, Daly and Valletta 2006) or decomposition of inequality by income sources instead of population subgroups (Karoly and Burtless 1995). The decomposition method proves to be useful in studying individual effects of each household group on inequality. With the method it is possible to extract for example both the effect of never-married single-parent households and widowed and divorced single-parent households into the overall inequality. However, even though methods of the U.S. studies vary, they do find similar patterns for how household structure changes affect income inequality.

The method of Burtless (1999) is to assign males in 1996 the earnings level rank that they would have had in 1979. The males' income was multiplied by the ratio of male earnings in 1996 to 1979, to get the real value of income in 1996. By studying the Gini coefficient changes between the years, Burtless finds that almost three quarters of the increased inequality would have been observed if the 1979 distribution of male earnings would have prevailed in 1996. He performs the same analysis using 1996 distribution: holding female earnings distribution constant, both male and female earnings distributions constant, holding husband-wife earnings correlation constant and holding proportions of single and married families constant. For the last mentioned, Burtless finds that one-fifth to one-quarter of the change in inequality can be traced to changing family composition.

While most studies use shift-share analysis, Karoly and Burtless decompose the Gini coefficient to account for contributions of different income sources. They analyze the changes in shares of incomes, Gini correlations and coefficients by these income sources.

They take for example the increase in male earnings Gini coefficient from 1969 to 1979 (their total period ranges from 1959 to 1989). When looking at Gini coefficients for male income separately for those families that had some male income and on the other hand looking at the fraction of families with no male income, the authors note that even though the male earnings Gini increased from 0.43 to 0.49 between the years, the Gini coefficient for male earnings among nonzero male earnings families (those families that had any male earning income) increased more modestly. This would imply the increase in inequality being caused largely by the shift in family composition: more people in the later year were living in families with no male head.

Daly and Valletta (2006) use a method similar to shift-share analysis based on conditional density estimation method (DFL) by Dinardo, Fortin and Lemieux (1996). The whole density of incomes is analyzed as opposed to the basic shift-share method that analyzes a single index number. Thus they derive more specific results of varying parts of distribution compared to basic shift-share analysis. They describe densities of incomes in a given year with the characteristics and their relationship to the income as they were in some other year.

With slightly differing methods, they confirm the earlier results by Karoly and Burtless (1995), Lerman (1996) and Burtless (1999) of earning incomes of men being the most important reason for income inequality during 1969–1989. They also strengthen the evidence of family structure playing a substantial role in increased inequality. Their method brings more detail into which part of the distribution the changes affected most. They find that the effects were concentrated on families with lower incomes and especially those with poverty risk. This goes hand in hand with Lerman's (1996) earlier work finding the family characteristics explaining much of child poverty increase in 1970s and 1980s.

Lerman (1996) as well as Martin (2006) also give attention to racial differences. The starting point in the United States is interesting because of varying ethnic base in the country. In Finnish context, racial differences are not large but might become increasingly interesting as immigration has increased. In the United States the family composition changes between different ethnic groups have been varying, leading to a situation where family structure has had different amounts of impact across these ethnic groups.

Lerman simulates marriages for unmarried men and women to imitate marriage patterns of population in earlier period to population of later period. He does an extensive analysis both in studying the marriage pattern effects for all of the population and doing the analysis separately for different races. Lerman finds that declining marriage rates account for almost half of the increase in inequality and virtually all of increase in child poverty in 1970s and 1980s, affecting black children the most. Martin notes that between 1976 and 2000 the relative contribution of family structure change on inequality was almost half of total for African Americans, 36 percent for whites, and 18 percent for Hispanics. Thus, as the ethnic groups vary, so does the contributions of family composition.

One important omission that the U.S. studies make is to look only at a proportion of population, taking into account only families and omitting single households and couples without children. The partial analysis for a population gives information only on the changes of inequality among families but not on whole population. Even though one would be interested only in changes in family composition, it is reasonable to include all population into estimation since the changes affect population as a whole – not just families.

For example Johnson and Wilkins (2003) include whole population over the age of 15 in their study. They analyze family composition and employment patterns and the distribution of income in Australia between the years 1982 and 1998, also using the DFL method. The composition of Australian family structure have had a trend towards smaller family sizes, an increase in the number of one person households, increase in the number of two adult households without children, increase in one-parent households and a decrease in nuclear families, the same kind of changes seen in Finland. There had also been a decrease in proportion of employed men and increase in proportion of employed women. Johnson and Wilkins find that changes in labour force participation have the most affluent impact on changes in inequality. They don’t find any significant impact of family size reduction on inequality but do find an equalizing effect of educational, age and country of birth changes in the population.

Jenkins (1995) studied the demographic changes’ effects in the United Kingdom, finding nearly no impact on inequality. The results are in line with those of Mookherjee and

Shorrocks (1982) who studied somewhat earlier time period in the UK. Jenkins studied a range of impacts from changing labour patterns to changing demographic features to find out which factors had been most fundamental in changing the income distribution between 1971 and 1986. He decomposes inequality indices both by population subgroups and by income sources to analyze different kinds of impacts on income inequality.

Jenkins studies age distribution changes, household composition changes (decline in household size, risen marriage ages, lowered average fertility and increased divorce rates), changing employment structure, changing industrial structure, unemployment changes, the business cycle effects, income tax and benefit changes, wage inequality changes, and changes in income from capital. In addition to decomposing inequality index by population subgroups and by income sources he also supplements decomposition methods with shift-share analysis. Decompositions by subgroups are done by dividing the population by age of household head, household composition and household's earnings status, household head's employment status and by region. Jenkins finds, using three different periods of 5 years that changes in the population such as declining household size have had nearly no impact on income inequality.

Jäntti (1997) also found little evidence of impact of demographic changes on income inequality in five countries. He studied shifts in age structure, family structure and number of earners and how they affected income inequality in Canada, the Netherlands, Sweden, the United Kingdom and the United States. Jäntti takes use of the decomposition method, decomposing mean logarithmic deviation to evaluate how changes in population shares, income changes and within-group inequality changes affect inequality as a whole.

Jäntti finds that most of inequality increase in the five countries occurred within the population groups. Change in relative sizes or income shares of population subgroups account for at most very small portions of total inequality changes, contrasting with the results of Lu et al. (2011) as well as the U.S. studies that found the family composition to have had a significant effect on income inequality in Canada and the United States. A fundamental difference between the studies is the population used: as noted earlier, the U.S. studies include only part of population in their analysis and thus they may find larger impacts for family composition changes. Jäntti's data also spans only a short period from

early 1980s to the mid-1980s (data span differs somewhat between the countries). It might be reasonable to question whether demographic shifts should be studied as a cause for as short a period because these shifts are slow in nature.

The question of aging and its impact on economic inequality is pondered in a study by Almås et al. (2010). They study age-structure changes in Norway during 1967–2000. The study is concerned about what consequences the baby boom cohorts being at the peak of their earnings have for income inequality. They calculate age-adjusted inequality measures to evaluate whether age structure is to be blamed for inequality increase. Their findings imply that age structure has a substantial effect on earnings inequality because of increase in the proportion of high-income receivers. They do note, however, that their results are very sensitive to the used method. If the large baby-boomer generation has been or is at the peak of their life-time incomes, it could be that as these generations get older and move on to populate the group of elderly, they may contribute to increased numbers of low-income receiving units, affecting the other end of the distribution.

Peichl et al. (2010) have recently studied household size in Germany from 1991 to 2007 and how it has affected income distribution. Following Mookherjee and Shorrocks (1982) and Jenkins (1995), the authors decompose inequality measures by population subgroups. In addition to using the decomposition method to inequality indices, they take use of similar methods for changes in poverty and richness measures. The authors find that demographic changes in Germany had some significant effect on inequality changes. They estimate about 15 per cent contribution of changes in household structure to inequality. The inequality would have increased without these changes as well.

An important aspect when one looks at demographic changes and changes in inequality is the role of government and how it suppresses factor income differences by income transfers. Peichl et al. (2010) discuss that the government has been able to decrease the inequality. They note that the household composition effect is larger for the income before tax and benefits, over 40 per cent. Thus the government redistribution mechanism has adjusted to the changing population such that it manages to dampen the income inequality caused by the demographic changes.

There might be some causal relationships acting behind demographic changes and government transfers. By transfers, government might encourage, for example, young people to move on their own earlier or the elderly to live on their own instead of living with their children and grandchildren in extended families. Thus government may somewhat encourage more individual lifestyles. In Finland, from 1935 up until as far as 1975, single households aged over 24 years were set an additional burden of taxes to encourage coupling and having children. Couples without children also faced additional taxes compared to couples with children. The taxes as well as reflecting moral attitudes of the time might well have had an effect on people's behavior.

Government may encourage individual lifestyles but on the other hand benefits to families with children may encourage behavior towards having more children. For example Gauthier (2007) reviews theory and empirics of family policies and fertility. She concludes that family policies (for example direct cash transfers for families with children, parental leave benefits or child-care facilities) have only small effects on fertility and may have more effect on timing of children than on actual family size.

On the other hand Vikat (2004) studied women's labour force participation, incomes, and child homecare allowance effect on childbearing in Finland 1988–2000. He finds that there is a positive relationship between women's participation in work and having children in Finland. High homecare allowances along with parental leave compensation that is paid as a percentage of women's earnings encourage women in the higher earning deciles to have children.

3.2 Research across countries

Some research has studied the wealth or income distributions and the demographic structure across different countries instead of looking at the changes in one country alone. Taking a cross-country comparison, OECD (2008) finds that the Gini coefficient for OECD countries with a higher share of people living alone tends to be actually lower than in the countries with less individualistic household characteristics. Share of single-parent families or share of elderly people of the population does not show a particular pattern for the Gini coefficient. Based on these kinds of comparisons it is thus difficult to say anything about

the universal effects of demographic features.

Bover (2008) studies wealth distributions in Spain and in the United States in the beginning of 2000s. These countries differ substantially in their family structures. There are clearly more single households in the US (29% of the population) as the youngsters move earlier apart from their parents than in Spain (17% of the population) and there are more single-parent families in the U.S. (24% of the population) compared to Spain (9% of the population). Bover estimates the counterfactual distribution in the U.S. that would have prevailed if the demographic features in the U.S. would have been similar to Spain. Bover finds the demographic features significant, accounting over 70% of the total changes between the countries in lower part of the distribution. However, these features do not account for the changes in higher parts of the distribution and the overall effect is nonexistent.

Brandolini and D'Alessio (2001) study income distributions of Italy - the most unequal European Union (EU) country along with the United Kingdom in the mid 1990s – and 11 other EU countries. They study the effect of changed features in the size of household units, and age and sex of household heads into income inequality by shift-share analysis. They study changes both inside Italy and between Italy and other EU countries –Finland among them.

In Italy during 1977 and 1995 trend in family structure was towards smaller family sizes and more people living alone than before. The proportion of families with a female household head more than doubled during the period and the proportion of households with over 64-year-old head increased, reflecting the aging of population. Average household sizes and proportions of one-person families were still larger than the EU average in mid 1990s. Brandolini and D'Alessio find that these differences cannot explain much of the higher inequality in Italy compared to other EU countries. Despite the changes in family structure in Italy and in most other EU countries, they find negligible relations between income distributions and family structure. For Finland, they find a small (about 4 per cent) change in inequality measured by mean logarithmic deviation if household characteristics of Italy were imposed in Finland.

An article by Kangas and Ritakallio (1998) studies income inequality in Scandinavian countries compared to France. They combine data sets of Denmark, Finland, Norway and Sweden to comprise one area, Scandinavia, which they compare to France. The interest is mostly in poverty measures. The Scandinavian countries differ in their demographic features compared to those of France. For example, the risk of poverty in Scandinavian countries is the highest for families of one and for families of over four whereas in France the poverty risk is growing more linearly with household size. Using a shift-share analysis in investigating the impact of demographic features on poverty in France and Scandinavia, they simulate the demographic properties (age structure, family size structure, labour force participation pattern and number of children per family) of France into Scandinavia and the other way around. They find that the poverty rate differences are caused by differences in family characteristics along with labour market behavior. Thus family composition is given a large role in contributing to poverty.

Studies about demographic features and their effect on income distribution mostly find that demographic features have had some effect but are not the main source of inequality. Some studies find no connection between the two. The U.S. studies rule out other population than families and might thus derive different results than when looking at the whole population. A popular method in previous research has been shift-share analysis which does not, however, give exact figures for inequality within and between population subgroups. The exact decomposition method is used in this paper since it offers exact calculations. It is argued to do better in differentiating varying contributions affecting inequality than the shift-share method.

3.3 Income inequality in Finland

In a global perspective, Finland among other Scandinavian countries is one of the least unequal societies. This is true whether we compare Finland to developing countries characterized by large income differences or to western countries which include a range of varying income differences. Income inequality has not been very high relative to other OECD countries out of which Finland had the 7th lowest income inequality measured by the Gini coefficient for household disposable income in mid 2000s (OECD 2008). The Gini coefficient in 2005 according to OECD was 0.27 while the average of OECD countries was

0.31. There has been, however, a substantial rise in inequality in Finland after the beginning of 1990's. The growth rate of inequality was one of the highest of all OECD countries during the period from mid-1990s to mid-2000s.

Development of the period from 1966 to 1976 was equalizing in terms of economic inequality. At the time, Finland was heading towards a Scandinavian welfare state with decreasing levels of inequality. During 1980s the level of inequality stayed relatively flat, continuing for the first years of 1990s, including the recession of 1991–1993 (See for example Riihelä et al. 2008 or Suoniemi 1999). Only the inequality measured by factor income increased during the recession, as a sign of the diversion in wages and property incomes. The large increase in unemployment rates in the first years of 1990s was a large contributor increasing the factor income inequality and could easily be considered as causing inequality measured by disposable income as well. This development of increased factor inequality, however, was dampened by social security system – taxes and government transfers – and the inequality measured by disposable income stayed low during the years of recession.

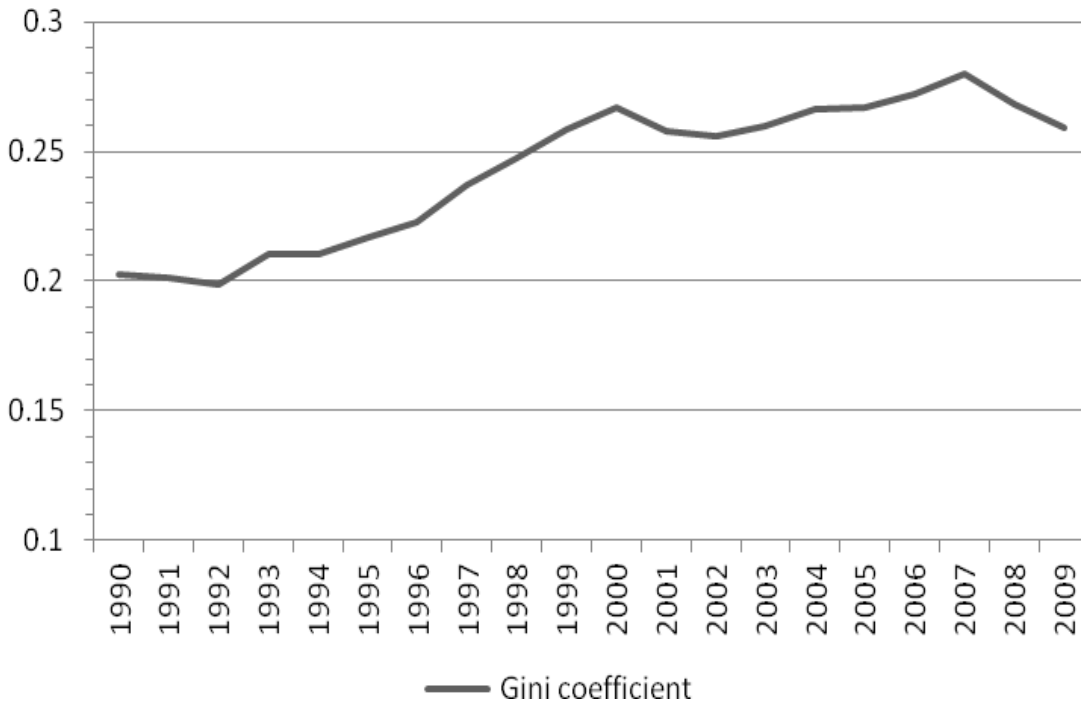
After 1993 the development has been to the opposite direction. The literature in Finland has seen change in taxation being a substantial factor in increased inequality. For example Riihelä et al. (2005, 2008) show that the increased income inequality has a strong connection with sharply increased incomes of the highest earners. This has been influenced by changes in income taxation: separated working income and capital income taxation has led to decreased progressivity in taxation since 1993. That year a dual taxation system was taken into use to reduce capital flow outside Finland and to secure the competitiveness in the more open and global economic environment. The dual taxation model in Finland is based on capital income tax being fixed while labour income is progressive.

Top income shares of total incomes have increased sharply after the taxation changes and the share of capital income of gross income has increased from early 1990s to mid 2000s, especially so with the highest income earners (Riihelä et al. 2005). There has been discussion of the dual taxation model bringing incentives to shift labour income into capital income (see for example Pirttilä and Selin 2006). Widening earnings dispersion, even though often brought up in inequality discussion, seems to have had a minor role in

inequality increase during the past two decades.

Figure 2 shows the path of the Gini coefficient for equivalent[4] disposable income for years 1990–2009. There is clearly a development of increasing inequality with some fluctuations over years. Increase of inequality is especially strong after 1995. Inequality rose until 2000 where after it saw a decline for a couple of years, only to rise to a new peak in 2007. Last years with available data, 2008 and 2009, Gini coefficient has decreased to below the peak of 2000. Two periods of declining inequality in the beginning of 2000s and the years after 2007 have been timed with economic downturns: the technology bubble of 2000 and the recent financial crisis.

Figure 2: Gini coefficient for equivalent disposable income 1990–2009.

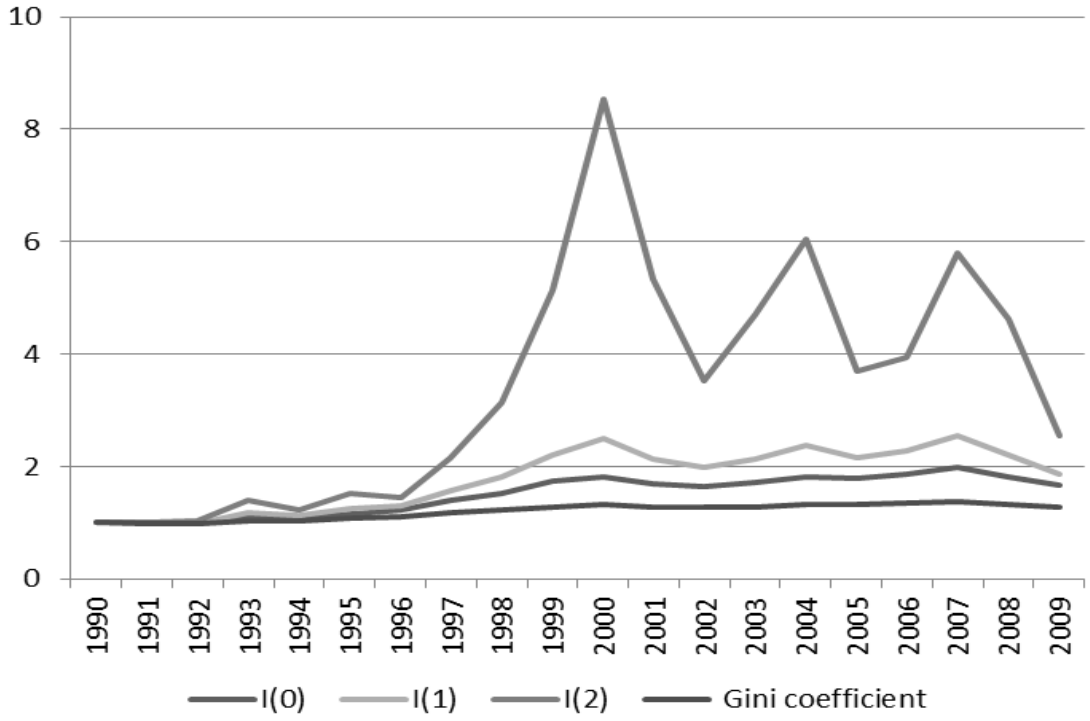


To compare Gini coefficient and the indices used in this paper, figure 3 plots the mean logarithmic deviation I_0, Theil index I_1 and half the squared coefficient of variation I_2 along with Gini coefficient into a same picture for 1990–2009. Indices are normalized such that the values are 1.00 in 1990. All indices give fairly similar picture of the evolution of

[4] The modified OECD scale is used as an equivalence scale. It gives weight 1 to the first adult, 0.5 to other adults and 0.3 to children under 14-years old in a family.

income inequality. Mean logarithmic deviation and Theil index are more moderate in their changes compared to half the squared coefficient of variation. Changes in the indices are into the same direction but the scale of changes varies, as the indices differ from each other. Gini coefficient ranges from zero to one, whereas general entropy indices have a lower limit of zero but don't have same kind of an upper limit as Gini coefficient does.

Figure 3: Mean logarithmic deviation I(0), Theil index I(1), half the squared coefficient of variation I(2) and Gini coefficient, 1990=1.00, 1990-2009.

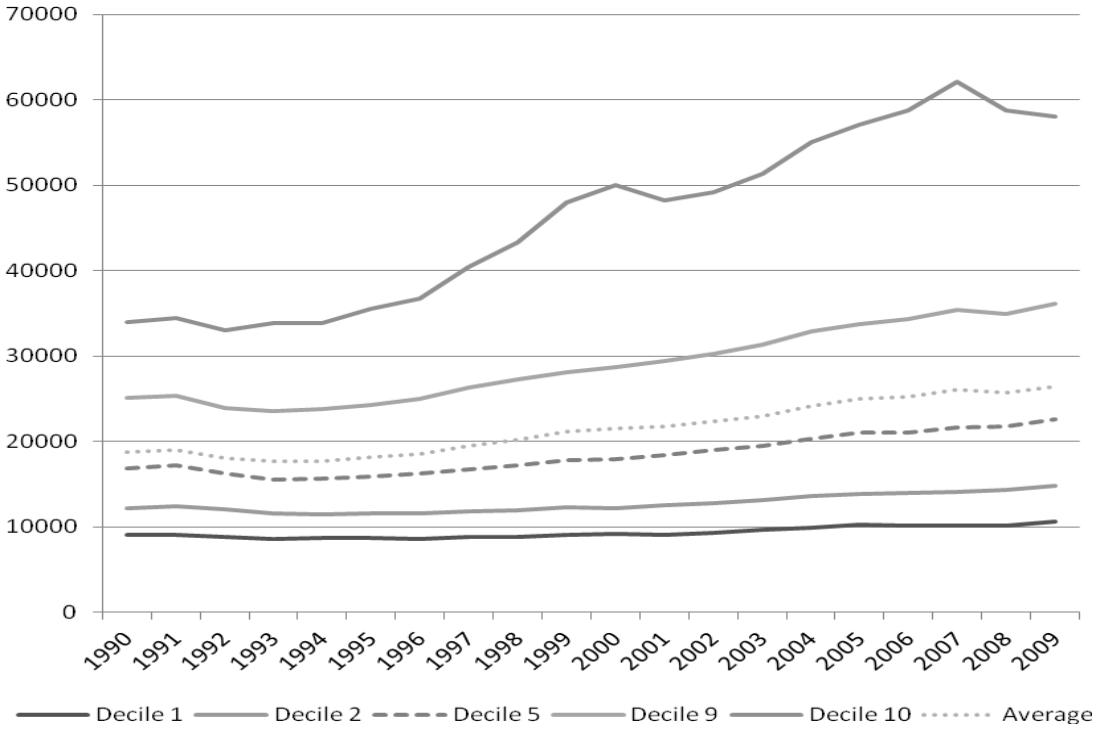


The mean logarithmic deviation gives more weight on changes on the lower parts of distribution whereas Theil index is neutral to different parts of the distribution and half the squared coefficient of variation gives weight to changes in higher incomes. The large changes in the coefficient of variation seen in figure 3 compared to those of the two other generalized entropy indices imply that there have been larger changes in the upper parts of the distribution than in the lower parts. The sharp increase before and until year 2000 and a sharp decline after year 2000 imply large changes in high incomes during these years.

Figure 4 depicts equivalent disposable incomes in 5 different deciles and the population average. Population is divided into deciles such that they are ordered by their incomes from

the lowest income receiving person to the highest. The first decile thus includes 10 per cent of population with the lowest incomes, and the tenth decile includes 10 per cent of population with the highest incomes. One can see that the mean disposable income of the highest decile has increased more rapidly than the incomes of other deciles. The increase from 1990 to 2009 has been over 70 per cent while the average increase of the population mean income has been 40 per cent. The incomes of the two lowest deciles have increased much slower, with 17 and 22 per cent increases from 1990 to 2009.

Figure 4: Equivalent disposable incomes in deciles 1,2,5,9, and 10, 1990−2009, in 2009 values.



Growth in the incomes of first two deciles have had a slow pace and it took almost ten years for those deciles to get back on the income level they had before the 1990s recession. While the first decile reached the pre-recession income level in 2002 and second decile in 2001, the tenth decile exceeded its pre-recession level already in 1995. Most of the increase in incomes in lowest deciles took place in 2000s.

The downturns after 2000 and 2007 are seen in incomes of highest deciles; their disposable incomes declined from 2000 to 2001 and from 2007 to 2009 more sharply than incomes of the other deciles. Disposable incomes of all other deciles but those of first and tenth

increased from 2000 to 2001. During 2007–2009 incomes of all other deciles but those of tenth decile increased. The decrease in 10^{th} decile incomes is affected by the large share of capital incomes of disposable incomes in this group. As the capital incomes declined at the time period, so did the disposable incomes of the highest decile.

Next we will turn to look at what has been the role of family composition changes in inequality. Contributions so far assessing impact of changes in demographic features on income inequality can be found in OECD (2008) and Riihelä and Sullström (2001). The former assesses household composition and age structure changes, as was earlier discussed. The latter looks at differences in major regions of Finland.

Riihelä and Sullström's study includes analysis of income differences in different regions from 1971 to 1998 using both consumption survey data and income distribution data. The population is divided into subgroups by geographic regions of Finland and inequality is decomposed by the regions with the same methods that will be used in this study. Their findings imply a convergence in relative mean incomes of regions until 1996 and increased inequality within regions especially after the first half of 1990s. Using decomposition of changes in MLD, they also study effects of household size, age of household head, education level and socioeconomic position on inequality. For household size changes they find increasing contribution with relatively highest effect during 1981–1990. The effect of age structure changes is smaller than the effect of household size, except for the last period, 1993–1998 when the effects are about the same.

In OECD (2008), the contribution of demographic features to overall inequality change was accounted to be about 16 per cent over 1986–2004. Contribution of changes in only household composition accounts for 13.7 per cent of total change and contribution of age structure changes accounts for 7.1 per cent of total change. Thus OECD finds family composition changes to have larger impact on inequality change than age structure, as Riihelä and Sullström do for time before 1993.

The OECD report uses a shift-share method with which one is unable to extract contributions of different factors. The following analysis will contribute to the subject by assessing incomes of household groups and contribution of household composition changes

on inequality using most recent data of Finnish incomes and a decomposition method that reveals more in depth information about specific contributions of inequalities of different groups than a simple shift-share analysis does.

4 Data and methods

Analysis is based on Income Distribution Surveys (IDS) by Statistics Finland for years 1990–2009. Data consists of sample surveys with about 10 000 households each year. The original data includes personal data on incomes as well as various other variables. The data is adapted to household level such that each observation represents one household. The IDS data is derived both from administrative registers and from survey questionnaire. Most of the income data is derived from national registers. The sample contains Finnish households but excludes those persons that live permanently abroad, don't have an address, or live in institutions such as hospitals or prisons. The data in different years until 2008 is formed such that each household is contained in the sample for two subsequent years. Since 2009 the IDS is formed such that each household is contained in the sample for four subsequent years. Thus in subsequent years a part of observations in the sample are the same.

Observations are given certain frequency weights (defined by Statistics Finland) so that the sample represents Finnish population and gives figures that correspond information of the whole population. Frequency weight of a household indicates how many households a certain observation represents in the population. Households are weighted by their probability of occurrence and the observations are multiplied by the number of household members to gain the population. The income measures of different years are realized by using living cost index with a base year of 2009.

The equivalence scale used to take into account household size and characteristics is modified OECD scale, which is recommended by Eurostat. Recently it has been a standard for income inequality studies across OECD countries, and thus, for comparable results I take use of this scale. The modified OECD scale gives weight 1.0 to the first adult in a household, and weight 0.5 to other over 14-year-old members in a household. A weight of 0.3 is given to under 15-year-old members of households. Thus, a family with two adults, one 15-year-old and one 10-year-old, is given an equivalence scale of 1.0+0.5+0.5+0.3 = 2.3. If total family income is 50 000 euros, an equivalent income for an adult person living in this family would be 50 000÷2.3 = 21 739 euros.

Groups in the analysis are formed using household characteristics. For descriptive analysis of changes in the relative amounts of population in certain types of households and their incomes, I define 15 groups which are the following: 1) single males under 65 years old, 2) single males over 64 years old, 3) single females under 65 years old, 4) single females over 64 years old, 5) couples with household head under 65 years old, 6) couples with household head over 64 years old, 7) couples with 1 child, 8) couples with 2 children, 9) couples with 3 or more children, 10) couples with all children over 17 years old, 11) single-parent families with 1 child, 12) single-parent families with 2 children, 13) single-parent families with 3 or more children, 14) single-parent families with all children over 17 years old and 15) other households.

The last group includes households that cannot be categorized under any of the other groups (for example communes). Household head is usually a person with the highest income within a household during the past 12 months (household head is defined in the data set by Statistics Finland). The purpose for dividing the under and over 65-year-old singles and the couples with household head under and over 65 years old is to separate the elderly households from the younger ones and thus take into account some of the effects of aging population.

For the decomposition analysis, it is safer to use smaller number of groups to make sure each group contains enough population. This prevents possible effects of sample variations to the outcomes. For example the group of single-parent families with three or more children includes about 1 per cent of population each year, with considerable fluctuations varying from 0.62 to 1.19. The variation in the aggregate group of single-parent households on the other hand is substantially smaller across years.

The groups in the decomposition analysis is reduced to 8: 1) singles under 65 years old, 2) singles over 64 years old, 3) couples with household head under 65 years old, 4) couples with household head over 64 years old, 5) couples with 1 or 2 children, 6) couples with 3 or more children or all the children over 17 years old, 7) single-parent families and 8) other households. The groups 5 and 6 divide families into those with 1 or two children and those with more children or all the children aged over 17 years. This grouping divides families by their age: families with 1-2 children are younger families and the families with 3 or more

children or all the children being over 17 years old have on average an older household head. The next chapter will explore how household characteristics and household incomes have changed during the past two decades and then goes on to decomposition analysis.

5 Analysis

Before going on to the decomposition analysis, I discuss demographic changes in Finland during the past couple of decades. This is done by looking at the proportions of different kinds of families and how they have evolved over time. Development of mean incomes of different household groups is also described before the decompositions. Inequality is then decomposed into inequality within and between household groups, and trends in inequality are decomposed to assess whether changes in household features have affected changes in inequality. Inequality is also decomposed by income sources to see how contributions of different sources of income have evolved over time. The last part of this chapter discusses reasons for changes in household structure.

5.1. Changes in household structure and incomes

The most conspicuous changes in household structure in Finland during the past 20 years are an increase in two-adult families with no children and a decrease in two-adult families with children. Table 1 presents the changes of proportions of population living in five different types of households: single households, couples without children, couples with children, single-parent households and other households (a more detailed table can be found in appendix 1). The proportion of population living by their own has increased from about 15.5 per cent in 1990 to over 19 per cent in 2009. Most of the increase (almost two thirds) is caused by an increase in number of single men under 65 years old, but the proportions of female under 65 years old, and singles over 64 years old have increased as well, with increases of 0.40-0.47 percentage points.

The proportion of couples without children has increased by over 9 percentage points. Over three fifths of this increase is composed of increase of couples with a household head under 65 years old, and the rest, less than two fifths, stems from increase of couples with a head over 64 years old. The former implies there is a trend of increasing amount of couples that never have children or postpone having children and the latter implies increased amount of elderly couples due to increased amount of elderly people overall[5]. In the near future we are

[5] The sample does not take into account individuals living in institutions so all the figures include only the elderly population that is able to live on their own.

likely to see larger increases of pensioner households as the generation born after war gets older.

Table 1: Proportions of people living in different types of households 1990–2009, %.

Year	Singles	Couples without children	Couples with children	Single parent house-holds	Other house-holds
1990	15.4	20.7	52.4	7.2	4.2
1991	16.0	20.6	52.8	7.5	3.0
1992	16.1	21.3	51.8	8.0	2.8
1993	16.5	21.8	50.4	7.8	3.5
1994	16.7	22.0	49.6	8.2	3.5
1995	16.7	23.4	49.1	7.9	2.9
1996	17.3	22.9	48.5	8.2	3.1
1997	17.3	23.6	47.8	7.8	3.4
1998	17.7	24.4	46.6	7.9	3.3
1999	17.7	25.5	45.7	7.9	3.3
2000	17.6	25.6	45.7	8.3	2.8
2001	17.7	26.3	45.5	7.6	2.9
2002	17.9	27.0	45.5	6.9	2.7
2003	17.7	27.7	44.6	7.1	2.8
2004	18.0	27.2	44.7	7.2	2.9
2005	18.2	27.7	44.7	7.1	2.4
2006	18.2	28.1	44.0	7.3	2.4
2007	18.7	28.3	43.7	6.8	2.5
2008	19.1	29.2	43.6	6.2	1.9
2009	19.0	29.5	43.2	6.6	1.8

While the number of childless couples has increased, the proportion of people living in nuclear families, with two parents and children has decreased quite much. Over half (53%) of population lived in nuclear families in 1990 whereas the figure was only 43% in 2009. A bit over half of the decrease comes from declined proportion of nuclear families with two children, which have decreased by five percentage points. The next largest effect has been the decrease of families where all children are over 17 years old. This figure reflects a trend of youngsters moving on their own early on, earlier than before. Quite interestingly, the proportion of nuclear families with 3 or more children hasn’t changed nearly as dramatically as the proportion of nuclear families with 2 children: the decrease has been

only under 0.2 percentage points from 12.8% to 12.6% against over five percentage point decrease of proportion in the 2-children families over the 20 years.

The proportion of single-parent families out of all families have increased. The increase is, however, mostly because of decrease of two-parent families and the proportion of population living in single-parent families has actually decreased somewhat. The population living in single-parent families increased from 1990 to 2000 (from 7.2% to 8.3%) but thereafter decreased such that the overall change from 1990 to 2009 has been a decline of about two third a percentage points with the proportion of population living in single-parent families in 2009 being 6.6%.

The proportions of single parents with 1 child and single parents with all children over 17 years old have declined and the proportion of single parents with 2 or more children has increased. However, the changes are not very dramatic and there are yearly fluctuations in the data that might be somewhat due to sample variations. Thus one should be cautious with interpretations of the smaller groups within the aggregate group of single-parent families and perhaps look mostly at the aggregate amount of those families. Even though it would be interesting to look at the very detailed distribution of people and the changes in them, it is a bit dangerous with the group proportions being small. Thus in the decomposition analysis later on I use one aggregated group for the single-parent families.

The group “other households” consists of households that could not be categorized into any of the other groups. It also consists of those households from which needed information couldn’t be obtained. The proportion of people living in this category has decreased over years. However, some of the decrease might be due to better registering of the households into the right categories instead of the amount of people living in “other households” actually declining. It is assumed in the paper that if some of the decline of the population in the category “other households” is due to better registration, then that population is evenly distributed over household types such that it does not affect the following analysis.

Next we will turn to mean incomes of different types of households. Table 2 presents relative disposable incomes of population in different household types with population average 1.00. The groups are formed as previously: single households, couples without

children, couples with children, single-parent households and other households (a more detailed table can be found in appendix 2).

Table 2: **Relative mean incomes of population in different kinds of households 1990–2009, equivalent disposable income, population average 1.00.**

Year	Singles	Couples without children	Couples with children	Single parent house-holds	Other house-holds
1990	0.82	1.11	1.03	0.88	0.92
1991	0.83	1.12	1.03	0.89	0.94
1992	0.83	1.13	1.02	0.89	0.96
1993	0.83	1.13	1.02	0.88	0.96
1994	0.82	1.13	1.02	0.88	1.04
1995	0.82	1.13	1.02	0.88	0.97
1996	0.82	1.14	1.02	0.87	0.93
1997	0.83	1.14	1.03	0.82	0.92
1998	0.80	1.16	1.03	0.81	0.97
1999	0.80	1.17	1.02	0.79	0.95
2000	0.81	1.19	1.01	0.78	0.96
2001	0.80	1.19	1.01	0.79	0.96
2002	0.80	1.17	1.02	0.80	0.90
2003	0.82	1.13	1.03	0.78	0.90
2004	0.80	1.15	1.03	0.77	0.93
2005	0.78	1.14	1.05	0.77	0.90
2006	0.79	1.15	1.04	0.76	0.87
2007	0.79	1.18	1.02	0.75	0.90
2008	0.79	1.17	1.01	0.81	0.90
2009	0.81	1.14	1.02	0.79	0.92

The household types clearly differ in their mean incomes. The average income for singles is well below the population average, as well as the income of single-parent families. The mean income of couples without children is well above the average and the incomes of nuclear families are slightly above the average. There are differences inside the aggregated household groups as well. Couples without children that have household head aged less than 65 years old have 1.17-1.27 times the average income over years whereas the couples with household head over 64 years old have incomes that are above average during only half of the years, ranging from 0.90 to 1.05. The families with three or more children are

clearly worse off than the ones with only one or two children. On the other hand population in families where all the children are over 17 years old is clearly better off than the average person.

The population which does best in terms of income is living in household type couples without children that have a household head under 65 years old. Their relative incomes rose from 1.18 in 1990 up to 1.27 in 2001, although it declined to 1.20 in 2009. At the same time the single parents with three or more children have relatively the lowest incomes. The relative incomes of single-parent households have declined during the 20-year period. The mean income of all single-parent households relative to the population was 0.88 in 1990 whereas in 2009 it was 0.79. The decline in the relative incomes in this group has been notable. The mean income of single males under 65 years old has declined as well, from 0.91 in 1990 to 0.85 in 2009.

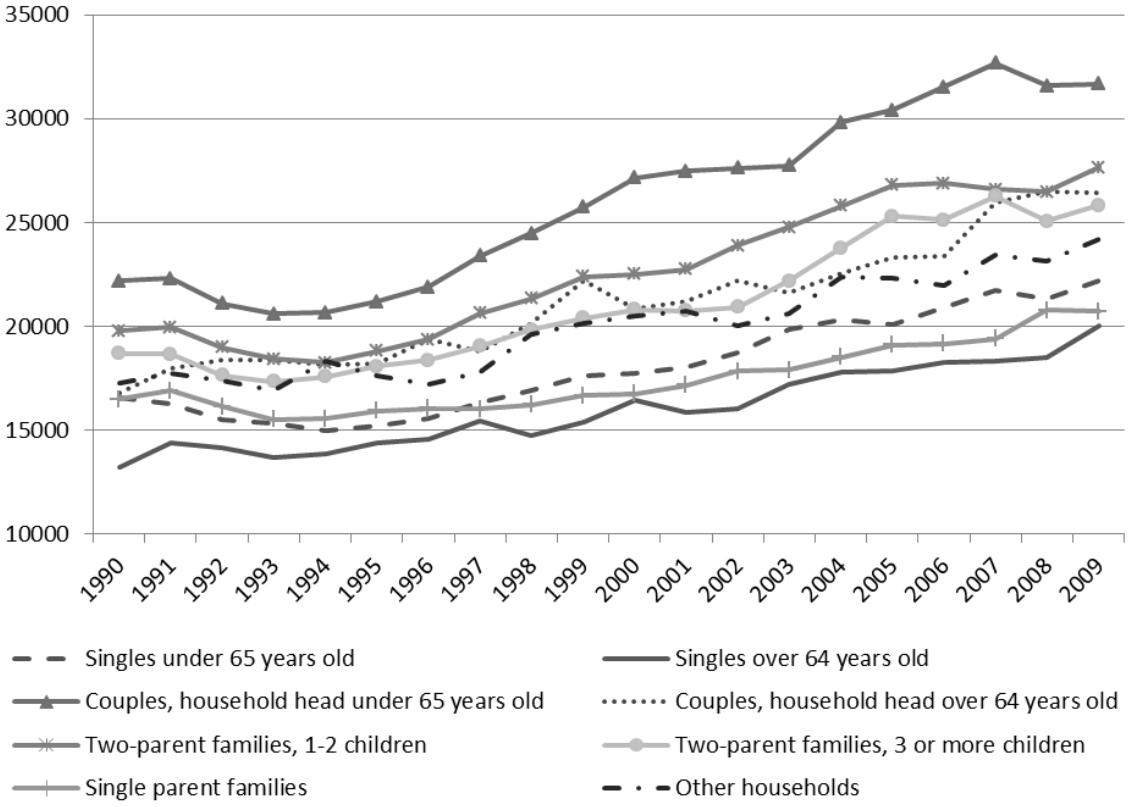
Pensioners have gained relatively in incomes during the time period. Both the old population living alone and the old population living in couple-households have relatively improved their incomes from 1990 although the single pensioners' incomes are still below the population average. It is also notable that female pensioners are better off in 2009 than 1990 although they are still worse off than male pensioners with a relative mean income of female 0.73 compared to relative income of male 0.84 in 2009.

Relative incomes don't give information about real income development of household groups which we will now turn to. If we look at absolute incomes and their development during the years we see that mean incomes in all household groups have increased. The mean equivalent disposable incomes in eight household groups are depicted in figure 5. One can see that all of the groups have experienced increase in their real incomes over the period.

The working-aged couples without children have the highest incomes and singles over 64 years old have the lowest incomes. If we look at the entire period of 1990 to 2009, the disposable incomes of pensioners have increased the most. The mean disposable income of single households of over 64-year-old has increased almost 52 per cent, and the mean disposable income of couples with household head over 64-year-old has increased with

over 57 per cent. The income development was weakest for the single-parent families, with an increase in disposable income of about 26 per cent.

Figure 5: Equivalent disposable incomes of household groups, 1990–2009, in 2009 values.



During the economic recession 1990–1993 incomes of households with over 64-year-old head increased while other household groups experienced a decrease in their incomes. In the second half of 1990s the incomes of couples with a household head under 65 years old increased the most, whereas in the 2000s the couples with a household head over 64 years old have seen largest increase in their disposable incomes.

Figure 5 shows that the mean incomes of different household groups have dispersed during 1990–2009. In 1990 the differences in mean incomes were smaller than in 2009. The dispersion in 2007 was largest where after for 2008 and 2009 the dispersion converged back somewhat as the incomes of the best earning group, working-aged couples without children, declined while at the same time the incomes of lowest earning group of single

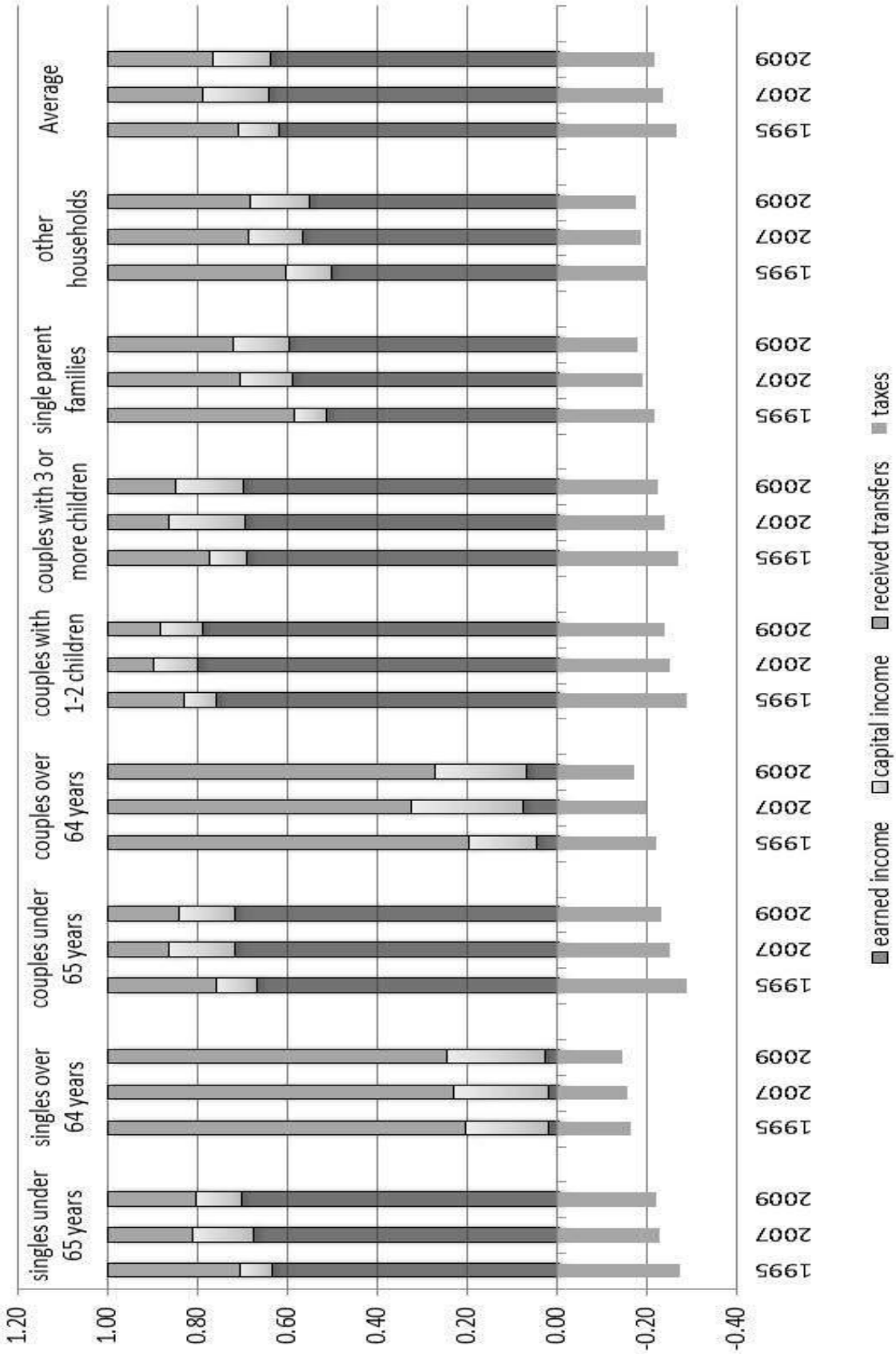
pensioners grew. Incomes of the working-aged declined during downturn of late 2000s whereas pensions, which make the most of pensioner's incomes, didn't see a decline during that time.

To see which components made up each household groups disposable income, we may look at figure 6. Income components are calculated as a share of gross income for easy comparison of different groups. The positive incomes are on the positive y-axis whereas taxes are on the negative y-axis. The share of taxes is also calculated as a proportion of gross income, thus showing the average taxation rate for each group. The figures are shown for years 1995, 2007 and 2009.

Most of incomes in the group of singles below 65 years old comprise of earned income and their share of gross income have increased from 1995 to 2009. Their capital incomes comprise 7-13 per cent during the years which is one of the lowest figures compared to other household groups. Their received transfers on the other hand are quite large, comprising about 20 per cent of gross incomes, although their share has dropped from 1995 to 2009. Incomes of over 64 years old single households naturally comprise mostly of received transfers and the share of earned income is very low since these households are usually not working. The share of capital income has increased from 1995 to 2007 and 2009 comprising about 22% of their gross earnings compared to 18% in 1995.

Incomes of working-aged couples without children comprise mostly of earned income. Their share of gross incomes has increased from 1995 to 2009. The share of received transfers for this group has become relatively less meaningful, comprising 24 per cent of gross income in 1995 and 16 per cent in 2009 whereas capital incomes have increased their share somewhat from 1995 from 7% to 10% (13% in 2007). This group has on average the highest tax rates along with couples with one or two children. This is true for all the years but the average tax rate has declined from 29 per cent in 1995 to 24 per cent in 2009. The group also has the highest absolute mean earnings income if we compare it to other household groups.

Figure 6: **Earned income, capital income, received transfers and taxes as proportion of gross income for household groups, 1995, 2007 and 2009.**



Incomes of couples with household head over 64 years old comprise mostly of received transfers. In 1995 they comprised about 80 per cent of group's gross income, but in 2007 their share was 67 per cent of gross income. At the same time capital income's share of gross income increased from 15 per cent to 25 per cent, although it decreased back to 21 per cent in 2009. Pensioner couples have on average largest capital incomes compared to other household groups.

Families with one or two children have incomes comprising mostly of earnings income. Share of earnings income of gross income is clearly highest for this group and on the other hand the share of received transfers is one of the lowest for this group. Capital income comprises about ten percent of this group's gross income for all the years. In 1995, large families with three or more children, or all children over 17 years old relied more on received transfers than their peers in smaller families. On the other hand, in 2007 their capital income share of gross income increased while transfers' relative share decreased. The share of earned income for this group has stayed relatively stable, being about 70 per cent of their gross incomes.

Received transfers comprise clearly larger part of single parent families' gross incomes than they do in other families. In 1995, 41 per cent of single parent families' gross incomes comprised of received transfers. Single parent families have the disadvantage of having only one adult who can work and bring earnings income to the family. The share of their earned income of gross income has increased, however, from 1995 to 2009. This is both because the absolute mean earned income increased as well as a decrease in their received transfers. The group pays least taxes right after over 64-year-old singles.

5.2 Decomposition of inequality by subgroups

Relative incomes and real incomes of different groups are informative for looking at differences in average incomes of household groups. They don't, however, reveal how inequality in Finland is comprised and whether it is due to differences between household groups or variation within household groups. This part decomposes inequality to understand how it is comprised and whether inequality stems from differences within or between household groups.

Inequality indices are decomposed by the household groups into within and between group components as described in section 2.3. The inequality measures shown are mean logarithmic deviation, Theil index and half the squared coefficient of variation, described earlier in chapter 2 - equations (2), (3) and (4). The subgroup division is following: 1) singles under 65 years old, 2) singles over 64 years old, 3) couples with household head under 65 years old, 4) couples with household head over 64 years old, 5) couples with 1 or 2 children, 6) couples with 3 or more children or all children over 17 years old, 7) single-parent families and 8) other households.

In table 3 one can see the total inequalities along with the within and between group components derived for mean logarithmic deviation I_0, Theil Index I_1 and half the squared coefficient of variation I_2 for years 1990, 1995, 2000, 2007 and 2009. The table also contains figure for share of between group component compared to the aggregate inequality value in percentages (B/aggregate). The between group component shows the group effect on the inequality.

Table 3: **Decomposition of Mean logarithmic deviation I_0, Theil index I_1, and Half the squared coefficient of variation I_2 for equivalent disposable income, 1990, 1995, 2000, 2007 and 2009.**

I_0	1990	1995	2000	2007	2009
Within	0.062	0.075	0.114	0.124	0.106
Between	0.008	0.006	0.012	0.014	0.010
Aggregate	0.070	0.081	0.126	0.138	0.116
B/aggregate, %	11.0	7.5	9.8	10.1	8.5
I_1					
Within	0.062	0.081	0.161	0.164	0.120
Between	0.007	0.006	0.012	0.014	0.010
Aggregate	0.069	0.087	0.174	0.177	0.130
B/aggregate, %	10.6	6.8	7.1	7.7	7.5
I_2					
Within	0.071	0.113	0.650	0.436	0.188
Between	0.007	0.006	0.012	0.013	0.010
Aggregate	0.078	0.119	0.663	0.450	0.197
B/aggregate, %	9.3	5.0	1.9	3.0	4.9

The within group component calculated by each of the three inequality measures explains most of the total inequality each year. If we first look at the mean logarithmic deviation we see that the overall inequality increases from 1990 to 2007 and the values of both within and between group components rise. The group effect during the period calculated by the between group element decreases from 11% in 1990 to 9.8% in 2000 and 10.1% in 2007. From 2000 to 2005 and from 2005 to 2007 the overall inequality decreases. From 2000 to 2005 the between group inequality rises a bit but decreases again in 2009. Overall, most of the inequality is explained by the inequalities within household groups instead of the differences of the household groups, measured by MLD.

Theil index also shows an increasing trend in the overall inequality from 1990 to 2000 and 2007 and a decrease from 2007 to 2009. The group effect decreases between 1990 and 1995, increases somewhat from 1995 to 2007 and decreases from 2007 to 2009. Overall the between group element contributes with a minor proportion to the inequality. Thus the differences between the mean incomes of household groups are causing only minor part of the overall inequality and most of the inequality is due to differences within groups.

The coefficient of variation shows the same trend for overall inequality but gives even lower proportions for the between group element for each year compared to the other indices. Both the within and the between group components rise from 1990 to 2000 as the total inequality value rises. However, the share of the between group inequality of the total inequality decreases substantially, from over 9 per cent to less than 2 per cent. Thus the inequality within the groups is explaining most of the inequality measured with I_2 and the group effect accounts for a very small part of the total inequality, almost none in 2000. I_2, unlike other indices, show a decrease in inequality from 2000 to 2007.

In summary, the decompositions show that household group differences have been decreasingly affecting inequality from 1990 to 2009. Differences of household groups, at least as they are divided here, do not explain much of the overall inequality in the population. Division that takes into account eight very different kinds of households, both by composition and age, is not a grouping that would explain inequality with group differences.

Why the different measures give different values and trends for the within and between

group components is due to the emphasis these indices put on different parts of the distribution. I_2 measure gives more emphasis on the changes affecting upper parts of the income distribution and hence changes in the higher incomes affect the index more than they do I_0 or I_1. The components of indices contain the relative population shares, relative mean incomes of population and inequality within each group. The within group component in half the squared coefficient of variation gets larger than in the other indices as the within group inequalities get higher values with this index. Thus the share of between group element calculated by the squared coefficient of variation is smaller than with the other indices. Overall all the indices still do give same information: a minor amount of inequality is due to the income differences between household groups.

Inequality is thus mostly explained by the differences inside the household groups. The within group inequalities of each household group are depicted in table 4 measured again with I_0, I_1 and I_2. Earlier in table 2 and figure 5 we saw relative mean incomes and real mean incomes of each household group, but they did not reveal anything about the dispersion within household groups. Table 4 instead describes inequalities within the groups. The inequalities measured by I_0, I_1 and I_2 are presented for each group for years 1990, 1995, 2000, 2007 and 2009.

Each index in table 4 shows that inequality within single households aged less than 65 years old is one of the most unequal group. Thus, even though their mean income is below average compared to whole population there is much variation in incomes inside this group. The variation implies heterogeneity in characteristics of the members of this group since it includes both relatively poor students for example, and on the other hand very well-earning working-age population. The group of single-parent families on the other hand is one of the least unequal. This group is more homogenous already by its definition than singles below 65 years old. Closer analysis for specific features of each household group is here left outside the analysis and for future research.

Table 4: Within household group inequalities 1990–2009 measured by mean logarithmic deviation I_0, Theil index, I_1 and half the squared coefficient of variation I_2.

	Single under 65 years	Singles over 64 years	Couple, household head under 65 years	Couple, household head over 64 years	Couples, 1-2 children	Couples, 3 or more children	Single parent families	Other households
I_0								
1990	0.105	0.060	0.076	0.065	0.049	0.057	0.052	0.052
1995	0.115	0.064	0.093	0.059	0.062	0.072	0.055	0.064
2000	0.144	0.136	0.155	0.094	0.094	0.107	0.073	0.069
2007	0.186	0.079	0.134	0.134	0.088	0.143	0.109	0.090
2009	0.160	0.096	0.116	0.081	0.089	0.107	0.093	0.083
I_1								
1990	0.100	0.067	0.075	0.071	0.050	0.057	0.053	0.052
1995	0.116	0.080	0.100	0.065	0.070	0.081	0.056	0.062
2000	0.145	0.345	0.251	0.122	0.117	0.133	0.075	0.070
2007	0.220	0.093	0.165	0.206	0.097	0.235	0.152	0.093
2009	0.146	0.109	0.161	0.089	0.116	0.180	0.067	0.110
I_2								
1990	0.113	0.080	0.085	0.088	0.055	0.063	0.059	0.054
1995	0.137	0.120	0.144	0.078	0.093	0.123	0.063	0.066
2000	0.193	3.281	1.340	0.230	0.204	0.220	0.094	0.077
2007	0.448	0.132	0.326	0.601	0.137	0.991	0.438	0.124
2009	0.226	0.277	0.186	0.157	0.136	0.241	0.184	0.118

If we look at how inequalities inside household groups have changed, inequality in group of singles under 65 years old has increased the most in absolute terms measured with I_0. Measured by I_1, inequality has increased most among couples with household head under 65 years old. Inequality among couples with 3 or more children has increased the most measured by I_2. Because of the weights that the different measures assign, we may conclude that there have been changes in the incomes of low income receivers who are singles under 65 years old more so in this group than in others. On the other hand, the high incomes within the group couples with three or more children have dispersed most and the right tale of distribution of this group has enlarged.

To further analyze how incomes in different household groups are divided, table 5 depicts inequalities decomposed into within and between group elements for earned income, capital income and received transfers. Earned income includes labour income and entrepreneurial

income. The decomposition is done only for inequality measure I_2, half the squared coefficient of variation, since it can deal with zero observations unlike MLD or Theil index.

The aggregate inequality is naturally higher for earned income, capital income and received transfers than for disposable income. The amount of inequality measured for earned income increased from 1990 to 2000 but decreased again from 2000 to 2007 and rose a little in 2009. The amount of earnings inequality within groups is again explaining most of the total earnings inequality but the share of the between group element is much higher for the earned incomes than for disposable incomes.

There are notable differences between household groups in how gross incomes are comprised as we saw in figure 6. There we saw that earnings incomes comprise naturally a high part of working aged couples' as well as singles' incomes but only a small part of pensioner incomes. On the other hand, proportion of single parent families' earnings incomes of gross income was smaller than for other families or singles. Those differences explain larger differences between groups in earned incomes than in disposable incomes.

Table 5: Within and between household group inequalities for earned income, capital income and received transfers in 1990, 1995, 2000, 2007 and 2009.

	1990	1995	2000	2007	2009
Earned income					
Within	0.213	0.335	0.440	0.309	0.327
Between	0.073	0.083	0.091	0.101	0.099
Aggregate	0.287	0.418	0.530	0.410	0.426
B/aggregate, %	25.6	19.9	17.1	24.6	23.3
Capital income					
Within	4.610	3.871	24.054	16.248	5.404
Between	0.071	0.035	0.052	0.050	0.033
Aggregate	4.680	3.906	24.107	16.299	5.436
B/aggregate, %	1.5	0.9	0.2	0.3	0.6
Received transfers					
Within	0.492	0.345	0.384	0.389	0.372
Between	0.245	0.135	0.208	0.276	0.275
Aggregate	0.738	0.480	0.592	0.665	0.647
B/aggregate, %	33.2	28.2	35.2	41.5	42.5

Notes: B/aggregate denotes proportion of between group inequality out of total inequality.

The aggregate inequality measured by I_2 is by far the largest when measured with capital income. Capital incomes are very unevenly distributed each year. Capital income inequality increased sharply from 1995 to 2000, implying there were large changes in capital incomes during the period that caused observed inequality. However, the between group element is very low compared to the aggregate inequality, only from 0.2 to 1.5 percentages of the total capital income inequality. Thus capital incomes are not concentrated on any particular household group but rather there is large variation in capital incomes of each household group. Differences in received transfers between household groups are large, accounting for about a third of overall inequality in 1990, declining somewhat in 1995 to rise again, accounting for over 42 per cent of aggregate inequality in 2009. This is mostly explained by the structure of incomes: as we saw in figure 6, received transfers vary much in making up household incomes.

This chapter has shown that observed inequality in disposable incomes could not be explained much by differences of household groups. The group effect on inequality has even declined during the years. The changes in the household groups might, however, have affected changes in inequality. The next section analyzes whether this has happened.

5.4. Decomposing changes in inequality

The previous analysis shows that major part of the inequality is within the household groups. The figures do not, however, reveal how much changes in the relative population share and relative incomes of the groups have affected the changes in inequality. The decomposition for the changes is done for inequality measure I_0 and is not an exact decomposition but an approximation. It is done for disposable incomes only, since the mean logarithmic deviation cannot by definition handle zero or negative observations which appear in earned incomes, capital incomes, received transfers and taxes.

In the equation (9) presented in chapter 2, we expect terms B and C to be relatively large compared to the overall inequality if the changes in the household structure has been a large contributor in the changes of inequality. A relatively large term D would indicate that the changes in the mean incomes of the groups have been a large contributor. If the term A is relatively large, one can say that the differences between the household groups have not

been a large contributor to inequality and the inequality is comprised of the inequalities within groups. Since population has shifted more into relatively well-off two-adult households without children and on the other hand into single households with relatively low incomes, we would expect to see household composition changes to affect increasingly on inequality, seen in terms B and C.

Table 6 summarizes decompositions for different periods, following trends of increase and decrease in inequality. It is clear from the table that term A dominates the changes in inequality. The contribution of household composition changes affect inequality increasingly during all the periods as expected. An exception can be found for the term C during 1990–1993. That time the changes in household composition affected decreasingly to inequality between groups although as term B is positive and larger than C, overall effect is increasing. The shifts in population caused within group inequality to increase more than between group inequality decreased.

Table 6: Decomposition of changes in inequality.

		Contribution to change in I_0 due to changes in				
	Total change in I_0	Term A	Term B	Term C	Term D	(B+C) /total
1990-1993	12.4	13.3	1.5	-1.1	-1.4	4 %
1993-2000	62.6	54.3	2.6	2.2	3.4	8 %
2000-2007	11.6	7.4	1.0	2.8	0.5	32 %
2007-2009	-13.7	-13.6	0.1	1.2	-1.4	-9 %

Notes: Differences in total change and A+B+C+D are due to rounding after calculations.

During time of high inequality increase in 1993–2000 changes in the household composition account for 8 per cent of the change in overall inequality measured by mean logarithmic deviation. Before this period the household composition appeared to account for even less of the change, about 4 per cent. However, from 2000 to 2007 the relative contribution of terms B and C are much higher compared to overall increase. During 2000–2007 household structure changes account over 30 per cent of the total change in inequality. If we look at the absolute contributions of terms B and C we see that they were the largest in 1993–2000. During the last period 2007–2009 when inequality decreased, the terms

contribute positively (adding inequality) to inequality value but with a low contribution. The negative term A is overweighing the increase contributed by household structure changes.

During the time when overall inequality has increased very much household composition had some but minor contribution to inequality whereas during time of lower increase the contribution of demographic changes was greater in proportion. These results are similar to those found in the U.S. (for example Karoly and Burtless 1995 and Martin 2006): when rise in inequality has been notable, changes in household composition has played a minor role. Even though there have been changes in household structures that have contributed increasingly in inequality these changes affected only little compared to changes within groups. Thus there have been other larger reasons behind the changes in inequality.

5.5 Decomposition by income sources and by groups

This part takes use of decomposing inequality by income sources (earned income, capital income, received transfers and taxes) and by household groups, in a same matrix, as is presented in Suoniemi (1999 pp.27) and used in Riihelä and Sullström (2001 pp.99). The method distinguishes contributions of each income source to the overall inequality by population subgroups. The decomposition is done for a few years to see the development of each income source and their effect on overall inequality.

Decomposition by income sources is based on Shorrocks (1982). We can calculate absolute contributions of each income source such that the sum of contributions equals the total inequality:

$$\sum_f S_f = I \qquad (10)$$

, where income source is denoted by f, and S_f is the absolute contribution of income source f to inequality I. If $S_f>0$, income source f contributes increasingly to inequality and if $S_f<0$, income source equalizes distribution. The proportional factor contributions can be written as

$$s_f \equiv S_f / I \tag{11}$$

Functions generating suitable values for s_f are decomposition rules, which Shorrocks shows to be independent of choice for inequality index. In principle there is infinite number of decomposition rules for each index. A single rule which he presents can be interpreted as an estimate of slope coefficient of a regression of total income on income source f.

$$s_f = \frac{\mathrm{cov}(y_f, y)}{\sigma^2} = \rho_f \frac{\sigma_f}{\sigma} \tag{12}$$

Here $\mathrm{cov}(y_f,y)$ is the covariance between income component f and total income and ρ_f is the correlation between income source f and total income. We can combine factor source inequality with group inequalities such that each factor contributes to group inequality with a factor s_{kf} and we can calculate contributions of each factor source by each group. Decomposition is done for squared coefficient of variation $2*I_2$ following Suoniemi (1999). Income source effect is calculated using income source contributions (12) for each group as following:

$$v_k \lambda^2 s_{kf} I_{2k} + v_k \frac{\mu_{kf}}{\mu}(\mu_k - \mu). \tag{13}$$

Summing (13) over groups gives us total contribution of each group. The group effect on inequality can be calculated as:

$$v_k \lambda^2 I_{2k} + v_k \frac{\mu_k}{\mu}\left(\frac{\mu_k}{\mu} - 1\right) \tag{14}$$

which gives us exactly the same measure as a sum of (13) over groups.

Table 7 presents a matrix where income source effects are calculated as (13) for each income source. The income source effects sum up to group effect, calculated by (14) and presented on the last column of the table. The sum of each column adds up to overall

contribution of each income source. The contributions caused by each income source in each group are identified in the matrix as well as contributions of inequality in each group to overall inequality. Figures are displayed as proportions to total inequality for easy comparison between years. Years for which the results are presented are 1990, 1995, 2000 and 2009.

The last row in the matrix for each year, the row for total income effects, shows that in year 1990 contribution of earned income was the highest of all income sources in comprising total inequality. In year 1990 other income sources but taxes increased inequality. During the other years received transfers also decreased overall inequality, but to a much smaller extent than taxes. Most of the inequality contribution of earned incomes each year was caused by inequality contributions of two groups: couples with household head below 65 years old and couples with 1-2 children. These groups also comprise almost half of the population so it is natural that inequality in those groups affects the total inequality with a high proportion.

It can be seen already in 1995 that the contribution of capital income has increased quite much compared to 1990. At the same time, the power of taxes in decreasing inequality has declined and the relative contribution of earned income has decreased notably. In year 2000 the relative contributions of earned incomes and capital incomes has reversed their positions and contribution of capital income to overall inequality has over doubled from 1995. Capital incomes in 2000 were clearly the largest contributor to inequality. This was especially because of capital income effect of the group couples with a household head less than 65 years old was large. The contribution of capital incomes was also large in single pensioner households.

Power of taxes in decreasing inequality has declined systematically from 1990 to 2009. Table shows that transfers to households have been a minor decreasing factor for inequality. Capital incomes have been an increasingly important contributor to inequality, while earned income has become relatively less meaningful. During the inequality peaks in 2000 and 2007, capital incomes were a larger contributor to inequality than earned incomes were. In 2009 their positions had reversed again, earned income being the largest contributor to inequality.

Table 7: Decomposition of squared coefficient of variation by income sources and household groups 1990, 1995, 2000 and 2009.

		Income source effect				
Year		Earned income	Capital income	Received transfers	Taxes	Group effect
1990	Single under 65	3.9	0.6	-3.2	-2.7	-1.5
	Single over 64	-0.1	-1.5	-10.5	0.6	-11.5
	Couple, household head under 65	74.6	5.9	8.1	-28.0	60.6
	Couple, household head over 64	0.0	0.5	-0.7	-1.2	-1.4
	Couples, 1-2 children	61.5	8.9	1.7	-26.3	45.9
	Couples, 3 or more children	6.0	4.5	12.8	-9.0	14.3
	Single parent families	-1.6	0.4	-3.1	-0.8	-5.1
	Other households	0.5	0.1	-1.2	-0.6	-1.3
	Total income effects	144.9	19.3	3.8	-68.1	100.0
1995	Single under 65	2.7	0.9	-5.7	-1.2	-3.3
	Single over 64	0.1	0.9	-5.1	0.0	-4.0
	Couple, household head under 65	51.3	17.8	7.9	-22.6	54.3
	Couple, household head over 64	0.7	2.1	4.3	-2.8	4.2
	Couples, 1-2 children	35.3	14.5	0.1	-16.7	33.2
	Couples, 3 or more children	17.9	10.5	-1.1	-8.7	18.5
	Single parent families	-0.8	0.2	-3.1	0.1	-3.7
	Other households	1.4	0.2	-0.2	-0.5	0.8
	Total income effects	108.8	46.9	-3.1	-52.6	100.0
2000	Single under 65	0.1	0.8	-0.9	-0.3	-0.2
	Single over 64	0.1	22.9	-1.0	-6.8	15.2
	Couple, household head under 65	26.3	69.0	2.1	-28.7	68.7
	Couple, household head over 64	0.4	1.9	0.5	-1.0	1.9
	Couples, 1-2 children	7.1	8.0	0.0	-4.4	10.7
	Couples, 3 or more children	3.8	3.9	-0.4	-2.2	5.0
	Single parent families	-0.8	0.1	-0.9	0.2	-1.4
	Other households	0.2	0.0	-0.1	-0.1	0.1
	Total income effects	37.2	106.8	-0.8	-43.2	100.0
2009	Single under 65	2.0	4.1	-2.7	-1.9	1.6
	Single over 64	0.4	3.3	-3.8	-0.7	-0.7
	Couple, household head under 65	44.0	21.0	4.4	-18.4	51.1
	Couple, household head over 64	1.9	5.1	3.0	-3.2	6.8
	Couples, 1-2 children	25.5	10.6	0.0	-11.0	25.2
	Couples, 3 or more children	7.0	18.3	-0.8	-6.9	17.6
	Single parent families	-2.3	2.2	-1.9	0.3	-1.7
	Other households	0.5	0.2	-0.2	-0.3	0.2
	Total income effects	79.2	64.8	-2.0	-42.1	100.0

We have looked at several decompositions in this chapter. The decomposition method has proven to be useful in several applications but it is not without problems. One of the problems of decomposing general entropy indices is that their variances might become high. This is brought up in Suoniemi (1999). Suoniemi decomposes the coefficient of variation and the Gini coefficient and shows that the decompositions of Gini gives less biased estimators than decompositions based on coefficient of variation.

Another criticism for the decomposition method is related to the mentioned problem of high variation. Decompositions of changes in inequality give slightly differing results when one changes the time span studied. The results are consistent, however, about the size of contribution that household structure changes have on inequality increase.

5.6. Interactions between incomes and family composition

As we earlier saw, changes in household structure has not been a major source of increased inequality. The changes in household composition have been large, however. Much of focus on literature is put on the effects of household structure changes in inequality. There might well be interactions playing behind both changes in inequality and changes in household structure. Families can be seen as an informal social security for its members. Family members share income-related risks through income pooling. Seen as an institution for risk-sharing and income pooling, family and changes in its composition can reflect changes in society's economic features. For example Becker (1993), in his work developing an economic model for family based on rational choices[6], explains changes in family formation to be mostly explained by female earning power increase, at least in the U.S.

The increasing trend of women participating in labour force has taken place in Finland as well. According to Becker, increase of female earnings increases relative costs for having children (due to opportunity cost of spending time on children) and thus explaining fertility decrease. In developed economies people don't see children as a security for future anymore. Neither are children needed for agrarian workforce in modern economies.

[6] In his much cited work, Becker seeks to analyze families on the basis of economic tools. He develops models of utility maximization to explain for example marriage formation patterns such as assortative mating and quantity and quality choices for having children.

Increased welfare overall as well as for example developed pension schemes that provide security for old age might affect the choices for coupling and having children.

Recent changes in women's participation in work outside home and their increased earning incomes are prominent in western countries. Most OECD countries saw a rise in female employment rate from mid 1980s to mid 2000s (OECD 2011). In Finland, there was a small decline in female employment rate; other countries with already large female employment rates also saw only small or negative changes in them. In Finland, rise in female employment rate took place earlier than in most other OECD countries.

Vikat (2004) finds that there is a positive relationship between women's participation in work and having children in Finland. OECD (2008) shows that in Finland women in middle three earnings quintiles have on average more children (1.7) than women in the lowest quintile (0.7) and women in highest quintile have on average the most children (1.9)[7]. Both these findings contrast Becker's view of increase in female earnings reducing the amount of children. This contrast, which is prevalent in other Nordic countries as well, is explained to be much because of compensation paid for women during parental leave, calculated as a high percentage of earnings (Vikat 2004). These compensations along with publicly subsidized childcare lower women's opportunity costs for having children.

Even though there seems to be no inverse relationship in Finland between female earnings and having children, change in women's earnings can affect coupling patterns. Increases in female earnings decrease women's need for economic security provided by their spouses – there is less need for marrying for economic reasons. The gain from marriage has been reduced and on the other hand divorce is less costly. Increase of single households may reflect this pattern. Sociologists have seen that reasons for marriage have changed as overall welfare measured by income has increased and especially the earning income of women. Marriage has become an institution based on love more than other (economic) reasons (Becker 1993).

By providing social security for those in need, state lowers the role of families providing the needed economic security. There are certainly some interactions between welfare state,

[7] OECD figures are calculated based on deciles of non-equivalent disposable incomes.

family formation and income distribution. These interactions, however, are difficult to observe and measure. As was seen earlier, family composition changes did not affect much on the rise of income inequality. However, the role of welfare state in the formation of households is unclear. Transfers dampen the effect of family formation changes by providing support for lower income households. Thus without the transfers we would have seen a steeper rise in inequality due to family composition change. Deeper analysis of interactions between household changes and changes in economic environment as well as welfare state is beyond the scope of this thesis and is left for future research.

6. Conclusions and discussion

With income distribution data covering twenty years in 1990–2000 this research investigates household structure changes and their effects on income inequality in Finland. Population is divided into household groups by their household structure to analyze differences between single households, couples, nuclear families and single-parent families. Members of general entropy family indices — mean logarithmic deviation, Theil index and half the squared coefficient of variation — are used to measure income inequality.

The paper finds that population has shifted from 1990 to 2009 away from the traditional family with two parents and children towards households with two adults without children and single households. This shift reflects more individual lifestyles of young people as well as aging of population leading to more pensioner single and couple households. It also reflects tendency to have fewer children, to postpone the age for having children, and increased amount of couples that don't have children at all.

Disposable incomes of different household groups vary: single adult households with and without children have relatively smaller incomes than households of two adults with or without children. Households of working-aged couples without children are doing best in terms of incomes. Although incomes of all household groups have increased in 20 years, some groups have on average gained more than others and the dispersion of mean incomes between household groups has widened. Single parent families' average income has increased the least while pensioner couples' incomes have increased the most. Single pensioners have had lowest disposable incomes during the whole time period but their incomes have increased much more than on average.

Household groups are not, however, homogenous groups in terms of incomes but inequalities within groups are large. Most unequal group in terms of disposable income is single households aged less than 65 years and inequality within this group has also increased relatively much from 1990 compared to other groups. The group of single-parent families on the other hand is one of the least unequal. Using measures that give different weights to different parts of income distribution reveals that within some household groups changes have taken place strikingly in highest incomes. Weighting lower parts of

distribution more, inequality has increased most within singles under 65 years old while weighting higher parts of distribution inequality among couples with 3 or more children has increased the most.

To determine whether the observed inequality is mostly caused by variation within household groups or by differences between household groups, inequality is decomposed into within and between group components. This is done by an exact decomposition method. Also the trends of inequality are decomposed to determine the contribution that household composition changes had on inequality changes. Most of the inequality is found to be caused by differences within household groups. Even though dispersion of household groups' mean incomes widened over the period, i.e. household groups did become more unequal, relatively the proportion of inequality caused by differences between groups decreased. Rising inequality within household groups was thus much larger contributor to total inequality during all years studied. The relative contribution caused by group differences declined from 1990 to 2009.

Household composition changes did affect increasingly on inequality throughout the entire period from 1990 to 2009. Changes in household composition are, however, found to have only a minor effect on overall change in inequality. The dispersion of incomes within household groups is mostly explaining the inequality increase. The contribution of household composition changes was small during the time when inequality increased sharply. Thus there were other large driving forces behind inequality increase during that time. The changes had relatively larger effect during slow inequality increase although in absolute terms, the effects were larger in 1993–2000 when the inequality increased the most.

The paper also examined different income components contributions to income inequality. It was done by using decomposition of inequality by income sources. This analysis showed that while inequality increased sharply from 1990 to 2009 the relative role of capital income increased as explaining overall income inequality. On the other hand, the role of labour income has decreased in determining overall inequality. The results confirm earlier results concerning Finnish income inequality. Labour income dispersion has relatively become less influential in explaining inequality. Large changes in half the squared

coefficient of variation, which emphasize changes in upper part of income distribution, together with larger role of capital incomes measured by the same index, imply that large capital incomes have affected much on income inequality. In 2000, capital incomes contributed to overall inequality more than earned incomes did, measured by half the squared coefficient of variation. The same was true for 2007 when inequality rose to a new peak.

While household composition changes are concluded to have had little effect on inequality, it may be argued, to what extend government, especially by its redistribution policies, affects family or household formation. Benefits to certain kinds of household types could encourage individuals to form these kinds of household types. Changes in economic environment most probably affect family formation patterns. For example, female income increase has led to women being less dependent on their spouses' earnings. How economic environment and government's redistribution policies affect family formation is left for further studies.

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APPENDICES

APPENDIX 1 Proportions of population divided into 15 groups by household

	Singles					Couples			Couples with children					Single parents					
Year	Male under 65	Male over 64	Female under 65	Female over 64	All singles	House-hold head under 65	House-hold head over 64	All couples	1 child	2 children	3 or more children	All children over 17	All couples with children	1 child	2 children	3 or more children	All children over 17	All single parent house-holds	Other house-holds
1990	4.5	1.1	5.2	4.6	15.4	15.2	5.4	20.7	11.0	21.4	12.8	7.2	52.4	2.1	1.6	0.7	2.9	7.2	4.2
1991	4.7	0.9	5.9	4.4	16.0	15.3	5.3	20.6	11.1	21.2	13.9	6.6	52.8	2.4	1.4	0.8	2.9	7.5	3.0
1992	5.1	0.9	5.5	4.6	16.1	15.6	5.7	21.3	10.8	20.1	14.3	6.7	51.8	2.2	2.0	1.0	2.8	8.0	2.8
1993	5.6	1.1	5.0	4.8	16.5	16.1	5.7	21.8	10.8	19.4	12.8	7.3	50.4	2.1	2.0	0.9	2.8	7.8	3.5
1994	5.7	1.3	4.9	4.9	16.7	16.5	5.6	22.0	10.2	20.0	12.5	6.8	49.6	2.3	2.1	0.6	3.1	8.2	3.5
1995	5.8	1.1	5.1	4.6	16.7	17.1	6.3	23.4	10.8	18.8	13.2	6.3	49.1	2.1	2.3	0.6	2.8	7.9	2.9
1996	6.2	1.2	5.4	4.4	17.3	16.6	6.4	22.9	10.8	18.3	13.0	6.4	48.5	1.9	2.2	0.8	3.3	8.2	3.1
1997	6.1	1.3	5.4	4.5	17.3	17.1	6.5	23.6	10.8	17.8	12.8	6.3	47.8	2.1	1.9	1.2	2.7	7.8	3.4
1998	6.3	1.2	5.6	4.6	17.7	17.9	6.5	24.4	10.4	16.9	13.1	6.2	46.6	2.4	2.0	1.1	2.4	7.9	3.3
1999	6.2	1.1	5.5	4.8	17.7	18.6	6.9	25.5	9.7	17.1	13.1	5.8	45.7	2.4	2.2	1.0	2.3	7.9	3.3
2000	6.4	1.2	5.3	4.7	17.6	18.8	6.8	25.6	9.4	17.0	13.3	6.0	45.7	2.2	2.1	1.2	2.9	8.3	2.8
2001	6.2	1.3	5.4	4.8	17.7	19.2	7.1	26.3	8.8	17.1	13.5	6.1	45.5	2.1	1.9	1.0	2.5	7.6	2.9
2002	6.2	1.4	5.5	4.9	17.9	19.6	7.4	27.0	9.0	17.4	13.0	6.0	45.5	2.0	1.8	0.9	2.2	6.9	2.7
2003	6.1	1.5	5.5	4.7	17.7	20.3	7.5	27.7	9.2	16.0	13.4	6.0	44.6	1.9	1.7	1.2	2.3	7.1	2.8
2004	6.2	1.3	5.6	4.8	18.0	19.4	7.8	27.2	9.3	16.1	12.7	6.6	44.7	1.8	2.1	1.2	2.1	7.2	2.9
2005	6.3	1.3	5.8	4.7	18.2	19.7	8.0	27.7	9.3	16.1	13.0	6.4	44.7	1.8	2.0	1.1	2.2	7.1	2.4
2006	6.4	1.4	5.7	4.6	18.2	19.8	8.3	28.1	9.3	16.0	13.0	5.5	44.0	1.7	2.3	1.1	2.3	7.3	2.4
2007	6.5	1.6	5.6	5.0	18.7	20.2	8.1	28.3	9.1	16.1	12.9	5.5	43.7	2.0	1.9	0.8	2.1	6.8	2.5
2008	6.5	1.6	5.9	5.0	19.1	20.8	8.4	29.2	9.0	16.2	13.2	5.2	43.6	1.7	1.9	0.8	1.8	6.2	1.9
2009	6.8	1.6	5.6	5.0	19.0	20.7	8.7	29.5	9.6	16.3	12.6	4.7	43.2	1.8	1.8	0.8	2.1	6.6	1.8

APPENDIX 2 Relative mean incomes of population in different kinds of households 1990-2009, equivalent disposable income, population average 1.00.

	Singles					Couples			Couples with children					Single parents					
	Male under 65 years	Male over 64 years	Female under 65 years	Female over 64 years	All singles	House-hold head under 65 years	House-hold head over 64 years	All couples	1 child	2 children	3 or more children	All children over 17 years	All couples with children	1 child	2 children	3 or more children	All children over 17 years	All single parent families	Other house-holds
1990	0.91	0.78	0.86	0.69	0.82	1.18	0.90	1.11	1.10	1.03	0.90	1.16	1.03	0.86	0.82	0.74	0.96	0.88	0.92
1991	0.87	0.84	0.85	0.74	0.83	1.18	0.95	1.12	1.09	1.03	0.90	1.17	1.03	0.88	0.85	0.73	0.97	0.89	0.94
1992	0.84	0.90	0.87	0.76	0.83	1.17	1.02	1.13	1.08	1.03	0.89	1.15	1.02	0.86	0.83	0.79	0.99	0.89	0.96
1993	0.87	0.84	0.87	0.76	0.83	1.17	1.04	1.13	1.09	1.02	0.89	1.14	1.02	0.79	0.85	0.75	1.00	0.88	0.96
1994	0.84	0.86	0.86	0.76	0.82	1.17	1.03	1.13	1.09	1.00	0.91	1.14	1.02	0.79	0.85	0.76	0.99	0.88	1.04
1995	0.85	0.96	0.83	0.75	0.82	1.17	1.00	1.13	1.09	1.01	0.91	1.18	1.02	0.83	0.86	0.81	0.95	0.88	0.97
1996	0.84	0.91	0.84	0.75	0.82	1.18	1.05	1.14	1.07	1.03	0.90	1.18	1.02	0.83	0.82	0.76	0.94	0.87	0.93
1997	0.84	0.87	0.84	0.78	0.83	1.20	0.97	1.14	1.12	1.02	0.87	1.21	1.03	0.79	0.80	0.73	0.91	0.82	0.92
1998	0.85	0.76	0.83	0.72	0.80	1.21	1.00	1.16	1.11	1.03	0.89	1.19	1.03	0.76	0.79	0.69	0.91	0.81	0.97
1999	0.86	0.76	0.80	0.72	0.80	1.22	1.05	1.17	1.07	1.06	0.88	1.16	1.02	0.77	0.75	0.66	0.90	0.79	0.95
2000	0.84	0.73	0.81	0.77	0.81	1.26	0.97	1.19	1.07	1.03	0.88	1.17	1.01	0.77	0.73	0.67	0.87	0.78	0.96
2001	0.84	0.75	0.82	0.73	0.80	1.27	0.98	1.19	1.06	1.04	0.87	1.15	1.01	0.75	0.74	0.71	0.89	0.79	0.96
2002	0.85	0.75	0.83	0.71	0.80	1.24	0.99	1.17	1.08	1.07	0.85	1.13	1.02	0.76	0.73	0.70	0.93	0.80	0.90
2003	0.87	0.80	0.85	0.73	0.82	1.21	0.94	1.13	1.09	1.07	0.85	1.23	1.03	0.76	0.73	0.64	0.90	0.78	0.90
2004	0.87	0.84	0.80	0.71	0.80	1.23	0.93	1.15	1.06	1.07	0.87	1.20	1.03	0.74	0.74	0.64	0.88	0.77	0.93
2005	0.83	0.75	0.78	0.71	0.78	1.22	0.94	1.14	1.11	1.05	0.95	1.15	1.05	0.73	0.73	0.64	0.89	0.77	0.90
2006	0.86	0.82	0.79	0.69	0.79	1.25	0.93	1.15	1.04	1.08	0.89	1.24	1.04	0.71	0.74	0.59	0.90	0.76	0.87
2007	0.88	0.81	0.79	0.67	0.79	1.26	1.00	1.18	1.06	1.00	0.91	1.24	1.02	0.68	0.76	0.54	0.87	0.75	0.90
2008	0.85	0.80	0.81	0.69	0.79	1.23	1.03	1.17	1.06	1.02	0.89	1.18	1.01	0.74	0.85	0.64	0.90	0.81	0.90
2009	0.85	0.84	0.83	0.73	0.81	1.20	1.00	1.14	1.07	1.04	0.92	1.14	1.02	0.77	0.75	0.73	0.85	0.79	0.92

APPENDIX 3 Gini coefficients and General entropy measures 1990–2009.

	I_0	I_1	I_2	Gini coefficient
1990	0.070	0.069	0.078	0.202
1991	0.070	0.070	0.079	0.201
1992	0.068	0.069	0.080	0.199
1993	0.077	0.082	0.108	0.210
1994	0.074	0.078	0.096	0.210
1995	0.081	0.087	0.119	0.217
1996	0.085	0.090	0.113	0.223
1997	0.097	0.109	0.168	0.237
1998	0.106	0.127	0.243	0.247
1999	0.121	0.154	0.399	0.259
2000	0.126	0.174	0.663	0.267
2001	0.118	0.149	0.414	0.258
2002	0.115	0.138	0.274	0.256
2003	0.119	0.147	0.365	0.260
2004	0.126	0.165	0.468	0.266
2005	0.125	0.150	0.288	0.267
2006	0.130	0.158	0.306	0.272
2007	0.138	0.177	0.450	0.280
2008	0.127	0.154	0.359	0.268
2009	0.116	0.130	0.197	0.259

APPENDIX 4 Earned incomes, capital incomes, received transfers and paid taxes as proportions of gross income in 1995, 2007 and 2009.

		Earned income	Capital income	Received transfers	Taxes	Gross income
Single under 65 years	1995	0.64	0.07	0.29	-0.27	1.00
	2007	0.68	0.13	0.19	-0.23	1.00
	2009	0.71	0.10	0.19	-0.22	1.00
Single over 64 years	1995	0.02	0.18	0.80	-0.16	1.00
	2007	0.02	0.21	0.77	-0.16	1.00
	2009	0.03	0.22	0.75	-0.15	1.00
Couple with household head under 65 years	1995	0.67	0.09	0.24	-0.29	1.00
	2007	0.72	0.14	0.14	-0.25	1.00
	2009	0.72	0.12	0.16	-0.23	1.00
Couple with household head over 64 years	1995	0.05	0.15	0.80	-0.22	1.00
	2007	0.08	0.25	0.67	-0.20	1.00
	2009	0.07	0.21	0.73	-0.17	1.00
Couples with 1-2 children	1995	0.76	0.07	0.17	-0.29	1.00
	2007	0.80	0.10	0.10	-0.25	1.00
	2009	0.79	0.10	0.11	-0.24	1.00
Couples, 3 or more children	1995	0.69	0.09	0.22	-0.27	1.00
	2007	0.70	0.17	0.14	-0.24	1.00
	2009	0.70	0.15	0.15	-0.22	1.00
Single parent families	1995	0.52	0.07	0.41	-0.22	1.00
	2007	0.59	0.12	0.29	-0.19	1.00
	2009	0.60	0.12	0.28	-0.18	1.00
Other households	1995	0.50	0.10	0.39	-0.20	1.00
	2007	0.57	0.12	0.31	-0.19	1.00
	2009	0.55	0.13	0.31	-0.18	1.00
Average	1995	0.62	0.09	0.29	-0.27	1.00
	2007	0.64	0.14	0.21	-0.23	1.00
	2009	0.64	0.13	0.23	-0.22	1.00