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Stochastic Dominance Amongst Swedish Income Distributions

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Preface

Stochastic Dominance Amongst Swedish Income Distributions is a working paper within CEFOS research area 'Administrative and organizational aspects of the public sector'. Sweden's income distribution for the whole population and for subgroups, including its immigrants, has been extensively studied. The interest in this area has grown with increasing availability of data, including panels. The previous studies are based on indices of inequality or mobility. While indices are useful for *complete* ordering and have an air of "decisiveness" about them, they lack universal acceptance of the value judgements inherent to the welfare functions that underlay all indices. In contrast, uniform *partial* order relations are studied in this paper which rank welfare situations over very wide classes of welfare functions. We conduct bootstrap tests for the existence of first and second order stochastic dominance amongst Sweden's income distributions over time and for several subgroups of immigrants. Analysis of immigrant's income is motivated by the fact that the development of income for immigrants has been different and strongly affected by their length of residence and countries of origin. We consider eleven waves of a panel of incomes in Sweden. Two income definitions are developed. One is pre-transfers and taxes gross income, the other is a post-transfers and taxes disposable income. The comparison of the distribution of these two variables affords a partial view of Sweden's welfare system. We have focused on the incomes of Swede's and immigrant groups of *single* individuals identified by country of origin, length of residence, age, education, gender, marital status and other relevant characteristics. We find that first order dominance is rare, but second order relation holds in several cases. The working paper is written by Professor Esfandiar Maasoumi and Associate Professor Almas Heshmati.

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Lars Strömberg
Director, CEFOS

1. Introduction[1]

Sweden's income distribution for the whole population and for subgroups, including its immigrants, has been extensively studied. The interest in this area has grown with increasing availability of panels of data. Some attention has also been paid to income dynamics and mobility. See Creedy, Hart and Klevmarken (1980), Björklund (1993), Palme (1995), Gustafsson (1994), and Zandvakili and Gustafsson (1998). All these studies are based on indices of inequality or mobility. While indices are useful for *complete* ordering and have an air of "decisiveness" about them, they lack universal acceptance of the value judgements inherent in cardinalizations of welfare functions. This lack of consensus is problematic for policy analysis and decision making. When Lorenz or Generalized Lorenz (GL) curves of incomes cross, it is possible to portray contradictory pictures of inequality and "welfare" by different choices of indices of inequality or mobility.

Uniform *partial* order relations can be studied, however, which rank welfare situations over very wide classes of welfare functions. This type of welfare analysis avoids overly narrow cardinalizations of welfare functions represented by some indices. For instance, Stochastic Dominance (SD) relations are defined over broad classes of welfare functionals. We can now conduct empirical tests for the existence of such relations. If dominance of some order can be inferred, one has discovered a significant result, it would be redundant to report most inequality indices. If no such dominance is found, one has discovered an equally significant result indicating extreme caution in interpreting the

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meaning and even the value of index based welfare orderings and pronouncements. Lack of dominance relations means that welfare functions cross, and that, in turn, means that the choice of any index must be rigorously defended in specific decision situations.

The literature on this general topic is rich both within the "income inequality" tradition, as well as in a number of "causal" studies that have empirically examined the possible sources of "earnings mobility" and "wage dispersion". As examples in the latter tradition, Buckberg and Thomas (1995, 1996) and Montgomery and Stockton (1994) attribute wage dispersion to changes in employment in the durable manufacturing sector and investment in computer equipment, as well as the variance in the quality of labor and capital intensities across the sectors within manufacturing. Card (1996) and Bluestone (1990) investigate the impact of age/education and schooling, as well as industrial restructuring on wage dispersion. Among other studies of interest are Lindbeck and Snower (1996) who outline a theory that considers the versatility of work, the dispersion of wages by occupation and education, Gottchalk and Moffitt (1994) who argue that a growing "instability" in wages is causing the observed dispersion in wages, and Blau and Kahn (1996) who conduct a comparative study of wage dispersion among ten countries. Also see Juhn, Murphy and Pierce (1991, 1993).

The analysis in the wage dispersion literature is predominantly based on an index, namely the "variation" in a welfare attribute (e.g., earnings). As was established by the early debate on stochastic dominance (SD) vs "mean-variance" analysis, only for (near) Gaussian processes and/or quadratic utility functions would the latter rankings be equivalent to SD rankings. While econometric analysis is largely dependent on explaining "variation", unless broader dominance relations hold other indices can easily be found to contradict any welfare rankings implied by variances.

It seems that there is a wide chasm between the central quantities in welfare theory, and the quantity (variance) that has come to dominate the econometric analysis of "earnings mobility" or "wage dispersion". Panel data and related techniques in this literature have been very promising with regard to identifying statistical "causes" and other conditioning attributes. Also, we now pay much more attention to dynamic specification and endogeneity aspects of panel data models. But one might ask: What is being explained by these models? What is the effect? In the welfare context it is reasonably safe to say that "variation" or "variance" have very dubious welfare standing. Dramatically different populations (distributions) may have identical or nearly identical variances. The welfare function underlying variance is dismissed out of hand by a comfortable majority of welfare theorists and philosophers.

To demonstrate but only a few of the shortcomings of "variation" as a measure of welfare, one might consider a population of three individuals. In the first period, one person is a gangster with a dollar, another a professional with a thousand dollars, and Bill Gates with about 50 billions. In a second state (year), the gangster gets Gates' wealth, Gates gets the gangster's, and the professional stays put (sounds familiar?). In a third state, another rotation, the professional becomes the billioner, and so on. An econometric analysis bent on explaining the sources of "variation" finds a good deal to explain. And the policy suggestiveness of such work is both undeniable and necessary to its value. For instance, one might find that earnings "mobility" is affected by skill, education, and women's increasing participation in the labor force. Most everyone you care to ask would agree that "mobility" is a "good" thing. But very few, almost all of them in a small group of welfare theorists, can tell you what "mobility" is, let alone the sense in which it is "good"! It is doubtful that many would agree to a welfare criterion that celebrates a high probability of millionairs going bankrupt and bankrupts becoming rich, in one period, and reverse positions in the next period. Yet markov chain models determining probabilities of movement, and panel data models "explaining" the statistical covariates in this setting are essentially limited to explaining the "variation". Even movement on the basis of returns to education, say, must have a clearly understood sense in which it is socially desirable.[2]

In a recent survey one of us has offered a synthesis which finds that, so far, the only coherent welfarist definitions for "mobility" are in terms of welfare functions that are increasing and concave. This is Pareto and inequality averse. These are also the very properties that are required in defining First and Second Order Stochastic Dominance (FSD and SSD). Such welfare functions register an increase in well being when there is upward mobility in a community, both in the mean, and toward greater equality (in the Pigou-Dalton sense), see Maasoumi (1998a and 1998b). It is imperative to be able to properly interpret the implied welfare inferences of econometric analyses when SD relations do not hold, at least to a statistical degree of confidence.

In this paper we consider statistical test procedures for first and second order stochastic dominance. The tests studied here are multivariate generalizations of the Kolmogorov-Smirnov statistics when weak dependence is permitted in the processes. In implementing these tests, our experience (see Maasoumi, Mills and Zandvakili (1998)) suggests that bootstrap is an attractive alternative to the existing approximate asymptotic methods.

Our interest centers on eleven waves of a panel of incomes in Sweden. Two income definitions are developed. One is pre-government household gross income, the other is a post-government disposable income in calculation of which all transfer payments and taxes are taken into account. The comparison of the distribution of these two variables allows a partial look at the impact of Sweden's welfare system in this context. Several population subgroups can be studied separately and in comparison with others. We have focused on *single* individual Swedes and immigrants identified by country of origin, length of residency, age, education, gender, marital status and other characteristics.

In practice, *numerical* SD rankings are rare. This has led to the development of higher order dominance conditions that represent increasing degrees of cardinalization. At the same time, the realization that all such comparisons are based on sample based (typically, nonparametric) estimates of distribution functions suggests that such comparisons are fundamentally statistical and should be tested accordingly. Interestingly, the statistical approach tends to deliver more "clear-cut" (statistical) decisions than is possible by numerical analysis!

Statistical theory for "ranking" populations has a long history and has developed quite rapidly in the last fifteen years or so. This history was concisely reviewed in Maasoumi, Mills, and Zandvakili (1998), heretofore referred to as MMZ. The basic characteristic of tests for rankings is that of ordered populations and hypotheses. Likelihood ratio and Wald-type tests have been and are being developed. These tests supplement other well known procedures based on one-sided Wilcoxan rank, and the multivariate versions of the Kolmogorov-Smirnov tests. See Anderson (1996), and Maasoumi (1998a) for a recent selective survey. A brief account is given in the next section.

[2] Recently Berkhauser and Poupore (1997) were surprised to see that a much higher variance in the US incomes/earnings compared to Germany does not support the supposition that there is higher "mobility" in the US. This is because mobility is measured with Maasoumi-Shorrocks-Zandvakili indices.

Our two *nonparametric* tests for First and Second order Stochastic Dominance (FSD and SSD, respectively) have also been studied by McFadden (1989), Klecan, McFadden, and McFadden (1991), and Kaur, Prakasa Rao and Singh (1994). These tests require Monte Carlo and bootstrap techniques for implementation.

The rest of the paper is organized as follows. Section 2 describes the tests for stochastic dominance, their distributional characteristics and the bootstrap techniques used. In Section 3 the data are presented. Section 4 contains the empirical results and their implications. We find that, for example, the younger age groups are generally favored by the welfare system, the newer, higher skilled immigrants are better off, as well as better treated by the welfare laws, and the country of origin matters a great deal. Section 5 concludes.

2. Test for Stochastic Dominance

Tests for Lorenz curve comparisons have been studied by, for example, Beach and Davidson (1983), and Bishop, Formby, and Thistle (1989). A finite number of ordinates of the desired curves or functions are compared. These ordinates are typically represented by quantiles and/or conditional interval means. Thus, the distribution theory of the proposed tests are derived from the existing asymptotic theory for ordered statistics or conditional means and variances. Recently Beach, Davidson, and Slotsve (1995) outlined the asymptotic distribution theory for cumulative/conditional means and variances which are the essential ingredients of Lorenz and GL curves, and in testing for third order stochastic dominance. To control for the size of the sequence of tests at several points the union intersection (UI) and Studentized Maximum Modulus technique for multiple comparisons must be employed.

More recently several non-parametric tests have been proposed for FSD and SSD which recognize that the underlying distribution functions are unknown and must be estimated. In the spirit of Kolmogorov-Smirnov (KS) tests, and for the case of *i.i.d* observations on independent variables (prospects), Kaur et al (1994) propose a consistent test of SSD which also depends on the union intersection methodology.

Alternatives to these multiple comparison techniques have been suggested which are typically based on Wald type joint tests of *equality* of the same ordinates, see Bishop, Chow and Formby (1994) and Anderson (1996). Xu, Fisher and Wilson (1995), and Xu (1995) take proper account of the inequality nature of such hypotheses and adapt econometric tests for inequality restrictions to testing for FSD and SSD, and to GL dominance, respectively. Their tests follow the work in econometrics of Gourieroux et al (1982) Kodde and Palm (1986), and Wolak (1991). The asymptotic distributions of these $\chi-bar$ squared tests are mixtures of chi-squared variates with probability weights which can be difficult to compute. The computation of the $\chi-bar$ squared statistic also requires Monte Carlo or Bootstrap estimates of covariance matrices, as well as inequality restricted estimation which requires optimization with quadratic linear programming.

McFadden (1989) and Klecan, McFadden, and McFadden (1991) have proposed tests of first and second order "maximality" for stochastic dominance which are extensions of the Kolmogorov-Smirnov statistic. McFadden (1989) assumed *i.i.d.* observations and independent variates, and derived the asymptotic distribution of the test, in general, and its exact distribution in some cases (see Durbin (1973, 1985), and Kaur et al (1994)). Klecan et al (1991) study this test by allowing for weak dependence in the processes both across variables and observations. They demonstrate with an application for ranking investment portfolios. Similarly, MMZ (1998) proposed bootstrap-KS tests and demonstrated with several empirical applications. We use the same bootstrap tests in this paper. In the following subsections some definitions and results are summarized which help to describe our tests.

Definitions and Tests

Let X and Y be two income variables at either two different points in time, before and after taxes, or for different regions or countries. Let $X_1, X_2, \ldots.., X_n$ be n not necessarily *i.i.d* observations on X, and $Y_1, Y_2, \ldots.., Y_m$ be similar observations on Y. Let U_1 denote the class of all utility functions u such that $u' \geq 0$, (increasing). Also, let U_2 denote the class of all utility functions in U_1 for which $u'' \leq 0$ (strict concavity), and U_3 denote a subset of U_2 for which $u''' \geq 0$. Let $X_{(i)}$ and $Y_{(i)}$ denote the *i*th order statistics, and assume $F(x)$ and $G(x)$ are continuous and monotonic cumulative distribution functions (*cdf*,s) of X and Y, respectively. Quantiles $q_x(p)$ and $q_y(p)$ are implicitly defined by, for example, $F[X \leq q_x(p)] = p$.

Definition 2.1. X First Order Stochastic Dominates Y, denoted X FSD Y, if and only if any one of the following equivalent conditions holds:

(1) $E[u(X)] \geq E[u(Y)]$ for all $u \in U_1$, with strict inequality for some u.

(2) $F(x) \leq G(x)$ for all x in the support of X, with strict inequality for some x.

(3) $q_x(p) \geq q_y(p)$ for all $0 \leq p \leq 1$.

Definition 2.2. X Second Order Stochastic Dominates Y, denoted X SSD Y, if and only if any of the following equivalent conditions holds:

(1) $E[u(X)] \geq E[u(Y)]$, for all $u \in U_2$, with strict inequality for some u.

(2) $\int_{-\infty}^{x} F(t)dt \leq \int_{-\infty}^{x} G(t)dt$, for all x in the support of X and Y, with strict inequality for some x.

(3) $\int_{0}^{p} q_x(t)dt \geq \int_{0}^{p} q_y(t)dt$, for all $0 \leq p \leq 1$, with strict inequality for some value(s) p.

The Lorenz curve of, for instance, X is $L_x(x) = (1/\mu_x)\int_{-\infty}^{x} XdF(t)$, and its Generalized Lorenz is $GL(x) = \mu_x L_x(x)$. Some authors have developed tests for Lorenz and GL dominance on the basis of the sample estimates of conditional interval means and cumulative moments of income distributions; e.g. see Bishop et al (1989), Beach et al (1995), and Maasoumi (1998b) for a general survey of the same.

Furthemore, when either Lorenz or Generalized Lorenz Curves of two distributions cross, unamiguous ranking by FSD and SSD is not possible. Whitmore introduced the concept of third order stochastic dominance (TSD) in finance, see (e.g.) Whitmore and Findley (1978). Shorrocks and Foster (1987) showed that the addition of a "transfer sensitivity" requirement leads to TSD ranking of income distributions. This requirement is stronger than the Pigou-Dalton principle of transfers since it makes regressive transfers less desirable at lower income levels. TSD is defined as follows:

Definition 2.3. X Third Order Stochastic Dominates Y, denoted X TSD Y, if and only if any of the following equivalent conditions holds:

(1) $E[u(X)] \geq E(u(Y)]$ for all $u \in U_3$, with strict inequality for some u.

(2) $\int_{-\infty}^{x}\int_{-\infty}^{v}[F(t) - G(t)]dt\, dv \leq 0$, for all x in the support of X and Y, with strict inequality for some x, with the end-point condition: $\int_{-\infty}^{+\infty}[F(t) - G(t)]dt \leq 0$.

(3) When $E[X]=E[Y]$, X TSD Y iff $\lambda^2_{x(qi)} \le \lambda^2_{y(qi)}$, for all Lorenz curve crossing points $i=1,2,.....,(n+1)$; where $\lambda^2_{x(qi)}$ denotes the "cumulative variance" for incomes up to the ith crossing point. See Davies and Hoy (1996).

When $n=1$, Shorrocks and Foster (1987) show that X TSD Y if (a) the Lorenz curve of X cuts that of Y from above, and (b) $Var(X) \le Var(Y)$.[3]

The tests of FSD and SSD are based on empirical evaluations of conditions (2) or (3) in the above definitions. Mounting tests on conditions (3) typically relies on the fact that quantiles are consistently estimated by the corresponding order statistics at a finite number of sample points. Mounting tests on conditions (2) requires empirical *cdf*s and comparisons at a finite number of observed ordinates. Also, from Shorrocks (1983) or Xu (1995) it is clear that condition (3) of SSD is equivalent to the requirement of Generalized Lorenz (GL) dominance. FSD implies SSD.

McFadden's analysis of the KS type tests requires a definition of "maximal" sets, as follows:

Definition 2.4. Let $Æ=\{X_1, X_2, ..., X_K\}$ denote a set of K distinct random variables. Let F_K denote the *cdf* of the *k*th variable. The set Æ is *first (second) order maximal* if no variable in Æ is first (second) order weakly dominated by another.

Let $X_{.n}=(x_{1n}, x_{2n}, ..., x_{Kn})$, $n=1,2,.....,N$, be the observed data. We assume $X_{.n}$ is strictly stationary and $\alpha-mixing$. As in Klecan et al., we also assume $F_i(X_i)$, $i=1,2,.....,K$ are *exchangeable* random variables, so that our resampling estimates of the test statistics converge appropriately. This is less demanding than the assumption of independence which is not realistic in many applications (as in before and after tax scenarios). We also assume F_k is unknown and estimated by the empirical distribution function $F_{kN}(X_k)$. Finally, we adopt Klecan et al's mathematical regularity conditions pertaining to von Neumann-Morgenstern (VNM) utility functions that generally underlie the

[3] This would appear to revive the coefficient of variation as a useful index of inequality. But a distinction needs to be made between the sequence of inequality restrictions between all *conditional* variances as well as the unconditional one, on the one hand, and only the latter condition, on the other.

expected utility maximization paradigm. The following theorem defines our tests and the hypotheses being tested:

Theorem 2.1. Given the mathematical regularity conditions;

(a) The variables in Æ are first-order stochastically maximal; i.e.,

(1) $d = \min_{i \neq j} \max_{x} \left[F_i(x) - F_j(x) \right] > 0,$

if and only if for each i and j, there exists a continuous increasing function u such that $Eu(X_i) > Eu(X_j)$.

(b) The variables in Æ are second order stochastically maximal; i.e.,

(2) $S = \min_{i \neq j} \max_{x} \int_{-\infty}^{x} \left[F_i(\mu) - F_j(\mu) \right] d\mu > 0,$

if and only if for each i and j, there exists a continuous increasing and strictly concave function u such that $Eu(X_i) > Eu(X_j)$.

(c) Assuming the stochastic process $X_{.n}$, $n = 1, 2, ..., N$, to be strictly stationary and $\alpha - mixing$ with $\alpha(j) = O(j^{-\delta})$, for some $\delta > 1$, we have:

$d_{2N} \rightarrow d$, and $S_{2N} \rightarrow S$, where d_{2N} and S_{2N} are the empirical test statistics defined as :

(3) $d_{2N} = \min_{i \neq j} \max_{x} \left[F_{iN}(x) - F_{jN}(x) \right]$ and,

(4) $S_{2N} = \min_{i \neq j} \max_{x} \int_{0}^{x} \left[F_{iN}(\mu) - F_{jN}(\mu) \right] d\mu.$

Proof. See Theorems 1. and 5 of Klecan et al (1991).

The null hypothesis tested by these two statistics is that, respectively, Æ is first (second) order maximal. We reject the null when the statistics are negative. Since the null hypothesis in each case is composite, power is conventionally determined in the least favorable case of identical marginals $F_i = F_j$. As is shown in Kaur et al (1994) and Klecan et al (1991), when X and Y are independent, tests based on d_{2N} and S_{2N} are consistent.

Furthermore, the asymptotic distribution of these statistics are non-degenerate in the least favorable case, being Gaussian (see Klecan et al (1991), Theorems 6-7).

As is pointed out by Klecan et al (1991), the statistic S_{2N} has, in general, neither a tractable distribution, nor an asymptotic distribution for which there are convenient computational approximations. The situation for d_{2N} is similar except for some special cases-see Durbin (1973, 1985), and McFadden (1989) who assume i.i.d. observations (not crucial), and independent variables in Æ (consequential). Unequal sample sizes may be handled as in Kaur et al (1994).

In this paper we estimate the empirical distributions of the tests by bootstrap. In our algorithm we compute d_{2N} and S_{2N} for a finite number q of the income ordinates. This requires a computation of sample frequencies, *cdf*s and sums of *cdf*s, as well as the differences of the last two quantities at all the q points. Next, bootstrap samples (typically 1000) are generated from empirical distributions of the differences, of the d_{2N} and S_{2N} statistics, and their bootstrap confidence intervals are determined. The bootstrap probability of these statistics being negative and/or falling in these intervals leads to an inference of dominance to a degree of statistical confidence.

3. Data

The Swedish Income Panel data are obtained from the filed annual income tax returns. Due to high labor force participation in Sweden most adults file an income tax return on an annual basis. Furthermore, many public sector transfers are considered as taxable incomes. From 1978, information on income tax returns are recorded in computer readable form and completed with other relevant information. Comparability of income variables over time is relatively high.

The data consist of one percent sample of persons born in Sweden and 10 percent of the immigrant population in Sweden during the period of 1982 to 1992. The sample contains individuals aged 20-55 years and living in Sweden continuously. In order to reduce the large annual sample size to a manageable level, the sample is restricted to immigrants that have entered Sweden sometime between 1968 and 1989 in three-year intervals. The difficulties associated with the measurement of pre- and post transfers incomes per weighted/unweighted household member resulted in our choice of analyzing only a sample of "single" individuals. Thus, the final sample contains a total of 46672 observations for the years 1982 to 1992.

A number of time invariant characteristics are used to group individuals. The groupings are made by gender (male and female), age intervals (20-30, 31-40, 41-55), level of education (secondary, high school, university), year of immigration to Sweden (1968, 1974, 1983, 1989), country of origin (Sweden, other Nordic countries, Europe, and other countries), marital status (unmarried, married but living separately, divorced, and widow/widower), and year of observation.[4]

Our results consider two income definitions. Gross income is the sum of labor income (wage and salaries, self-employment income), capital income (dividends and interest), capital gains/losses, and agricultural income less any income losses. Disposable income is the sum of Gross income and "public transfers" less total taxes. Public transfers cover transfers that are

[4] In grouping individuals we have aggregated ages, levels of education and country of origin to a fewer groups. For the immigration years and years of observation we have selected only a number of representative years to compare.

subject to income tax. It includes taxable transfers such as pension payments (base pension, additional pension), sickness benefits, unemployment benefits, labor market training program benefits, housing/rent support, social assistance, and student loans less repayment of student loans.[5] Tax is measured as the final total tax paid. The incomes, taxes and transfers are transformed to 1990 fixed prices using the consumer price index.

Since we do not resample from time series observations we do not have the problem of dependence that would require Moving Blocks and other bootstrap techniques. A simple percentile method is adequate for our cross section samples. But, when applying our technique to panels, it may not be reasonable to assume that the incomes of a given cohort are *independent* over time. For the Klecan et al (1991) limiting distribution results one would need to assume exchangeability of the incomes in different years, and $\alpha - mixing$ for each. In the case of our data waves, we have *i.i.d* observations and we feel that possible dependence of incomes over time is less of an issue since these samples are time series of cross sections.

Summary statistics of the data are given in Appendix B. The number of individuals born in Sweden is 4742 (10.2%). This segment of the sample is used as a reference group in our comparisons. It should be noted that immigrants are eligible to become a citizen of Sweden after five years of residence. Thus, we define immigrants by the individual's country of birth. The individuals are observed for a period of one to eleven years. A total of 37% of the sample individuals are observed during the entire period of study, 1982-1992. As expected the overall sample average gross income is larger (832, 924) than the average disposable income (756, 461). See Appendix B, panel H. The numbers in parenthesis are the mean and standard deviations of respective variables. Disposable income has much smaller dispersion. The taxes and transfers are found to be effective income equalizers. A number of individuals (13%) reported zero income, and zero tax payments (15%). A larger fraction of the sample (57%) is males. Single male immigrants are over-represented.

Detailed summary statistics and further information on our sample are presented in Appendix C. The annual sample size varies from 2679 to 7224 observations. The mean gross income and taxes varies over time depending on the state of the economy. The mean transfers and disposable income is continuously increasing over time. Following the tax reform of

[5] Since our sample contains only single households. The non-taxable transfers such as child benefits and payments targeted single parents are not causing any measurement errors.

1991, we observe a sharp increase in the levels of transfer and disposable income. Gross income and taxes are declining.[6] We find a positive relationship between the age and the mean and dispersions of the levels of income, transfers and taxes. The male segment earns on average a higher gross income but the reverse is true when the disposable income is considered. Females receive higher transfers although they have a higher frequency of non-zero income than males. In general females more often work part time and are paid lower salary.

We did not expect the immigrants mean income (transfers) to be decreasing (increasing) function of the length of their residence. This can be due to high frequency of pre-retirements among immigrants entering Sweden in early years. Recent waves of immigrants are more skilled in terms of education. When distribution of income by country of origin is considered the net transfer (transfers-taxes) is negative for the Swedes, other Nordic countries, West and South European countries, and US, while it is positive for the East European, Middle East, North African and Latin American countries. In terms of both types of incomes the divorced and widows/widowers are better off than unmarried and married females that are living separately from their husbands.[7] The level of gross income is positively correlated with the level of education. This relation is less obvious considering the disposable income.

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[6] To our knowledge there is no study of income distribution among immigrants in Sweden. Borjas (1994) provides an excellent survey of the economics of immigration. For a comprehensive analysis of the tax and benefit reforms in Sweden and an assessment of their effects on the income distribution, labor supply, welfare and equality in general, see Björklund, Palme and Svensson (1995), Björklund and Freeman (1995), Aronsson and Palme (1996), and Lindbeck (1997).

[7] The group of divorced and widow/widowers are older than the unmarried and married but not living with husband. Part of the level differences in their income could be attributed to the income age effects.

4. Empirical Analysis

4.1 Test results for age groups

The results for the age groups (20-30, 31-40 and 41-55) are divided into a comparison of different age groups within and between different cross sections (1982, 1987 and 1992). In Table 1, the within cross sectional results, namely a comparison of different age groups in the same year are presented. In Table 2, we provide a dynamic analysis, namely a comparison of the same age group at different points in time.[8]

The first panel of Tables 1 and 2, gives some statistical summaries, including the number of observation in each group. In the second panel our test statistics are summarized by their mean and standard errors, as well as the probability of the test being negative. All of these are from 1000 bootstrap samples. The first group is denoted the "X" distribution, and the second by "Y". Thus, "FSDxoy" denotes "first order stochastic dominance of X over Y", "SSDxoy" is similarly defined for second order dominance, "FOmax" and "SOmax" denote the "first and second order maximality" test, and so on.

The mean gross income of the first two age groups is decreasing over time. The variance of gross income is increased in 1987, substantially for the first and third age groups. The after taxes and transfers income is both increasing over time and by age of individuals.

From Table 1, it is seen that in terms of gross incomes, first or even second order dominance is rare between these age groups in 1982 and 1987. Exceptions are, the *second* order dominance of the youngest (20-30) group over the medium age group 31-40 in 1982, and over the oldest age group 41-55 in 1987 at sufficiently high probabilities (0.97). A weaker second order dominance (0.89) of the second age group over the third age group is observed. Predictably, the mean of S_{2N} is negative in all three cases. In the final period (1992) the youngest and medium aged groups dominate the oldest age group in the second order sense.

[8] To conserve space we have not reported all results in this paper. These can be obtained from the authors upon request. For an example of a complete result obtained from a comparison of two subgroups, see Appendix D.

In terms of disposable income, again first order dominance is relatively rare but second order dominance is found in most cases. The youngest age group both first and second order dominates the other two age groups, while the second group second order dominates the third group. In 1987 and 1992 only second order dominance of the first two groups over the oldest group is evidenced. The mean of S_{2N} is negative in all cases with observed dominance.

From Table 2, we observe that in terms of gross incomes, first and second order dominance is found for the same age groups over time. For the youngest and the medium aged groups, 1992 and 1987 both first and second order dominates 1982, while 1992 only second order dominates 1987. A similar but much weaker dominance relation holds in the oldest age group. In terms of disposable income with the exception of a second order dominance for the youngest age group no dominance relation holds for the same age groups over time.

Intended or otherwise, the government influence is to make the 20-30 year old singles the most well-off group relative to the U_1 and/or U_2 welfare functionals. The second most well-off are perhaps the 31-40 ages which form a first order maximal group that is second order dominant over the oldest group. It is reasonable to infer a negative relation between the within group welfare/equality and age. This is not implausible since, the greater differences in skills, education, and years of residence after immigration begin to produce greater differences in incomes. The government influence has enhanced the returns to these attributes. (See the large difference between the gross and disposable incomes of the 41-55 singles).

It appears that government programs are generally regressive toward the 1982 levels for all age groups. When one compares 1982 and other years for Gross Income, sometimes the latter years are dominant, at least in the SSD sense. But for disposable incomes, either the relation reverses in favor of 1982, or the two years are "unrankable". We find roughly the same pattern as when incomes were aggregated over time. The younger groups tend to do better than older, at least in the SSD sense. When they are unrankable for gross income, they become rankable, in the SSD sense after taxes and transfers are counted in.

4.2 Test results for levels of education

Table 3 has the same design as the previous two tables but reports our tests for three different education levels. The net effect of transfers and taxes is to increase the mean income of the two groups with fewer years of education, and decrease that of the most highly educated. The variance for all groups has decreased significantly as a result of taxes paid and benefits received.

There is an approximate hierarchy of university education being the most well off, followed by secondary education and high school, respectively. The group with university education is both first and second order dominant over the group with high school level education, whichever the income definition. The university group gross income does not dominate that of the least educated group of singles in our sample. Only after transfers and taxes are taken into account does the "university group" strongly dominate.

Interestingly, the gross income distribution of the secondary education group, second order dominates that of the high school graduates. But these two groups are not ranked when disposable incomes are compared. The effect of transfers and taxes is, it would appear, to ensure returns to schooling at all levels.

4.3 Test results for years of immigration

The nature of immigration to Sweden has changed when we compare those arrived in the 1960s and early 1970s with immigrants arrived in later decades. The 1960s immigrants are mostly individuals with low levels of education who immigrated to Sweden at a time of labor shortage in the manufacturing sectors. These are often employed in less skilled and heavy jobs and paid the minimum wage. A relatively high proportion of them are pre-retired and are paid by insurance wages which are much lower than full time wages. The immigrants entering Sweden in the late 1970s and 1980s are mostly refugees with relatively high levels of education. The latter group is found to have a higher potential in getting highly paid employment. The stream of immigration and their countries of origin differ over time depending on war and other factors causing immigration from different parts of the World to Europe.

It may be argued that immigrants expect to find a "better life" when they immigrate. It is equally plausible to expect that their lot will improve with time if they succeed and stay. It is also true that more recent immigrants are more skilled or better off when they become resident. Table 4 sheds some light on these issues. For all groups except the most recent immigrants (1989), mean incomes are reduced after taxes and transfers. All of the newer groups dominate the first group who came to Sweden in 1968. 1983 dominates 1974 in the first degree and for both income definitions. 1989 second order dominates 1974 in both incomes, and first order dominates after taxes and transfers. 1989 second order dominates 1983 before government programs, but is first order dominated by 1983 in disposable incomes. Thus, 1983 immigrants are the most well off after the effects of taxes and transfers are taken into account, followed closely by 1989 which dominates 1974, followed by 1968. It would seem that, whatever the benefits from the length of residence in Sweden, they are more than matched by skills and other characteristics of the newer generation of immigrants to Sweden.

4.4 Test results for countries of origin

In Table 5 we look at the comparisons by country of origin. It is noted that there are 4742 Swedish single individuals in our sample. The group of Swedish single individuals are used as a control group. We find that Swedes and European immigrants are maximal (unranked), and Swedes first order dominate all other single groups when gross income is considered. It follows (as is supported by the table entries) that, European immigrants first order dominate other groups of immigrants. For gross incomes the "other countries" group is only second order dominated by Swedes and Europeans.

The taxes and transfers seemingly benefit the latter two groups more than the "other countries" group. Interestingly, immigrants from "other countries" first order dominate the "other Nordic" immigrant singles. The welfare system does not change this strong order relation (but it does increase the mean income of the "other countries" immigrants while decreasing the other groups' mean incomes). It would be interesting to extend this study by controlling for age as well as these other attributes.

By this point the reader would have noted the unexpectedly large number of "decisive" statistical decisions/orderings that are obtained in our tests. While distributions and "Lorenz curves" cross quite frequently, these crossings are statistically insignificant.

4.5 Test results for gender

Table 6 concerns gender. The mean gross income of males is larger while the mean disposable income of females is greater. There is a greater reduction in the variance of male incomes, however, after taxes and transfers are included.

In terms of gross incomes male distribution first and second order dominates the females'. After taxes and transfers, however, only second order dominance can be safely inferred. Noting the progression toward a preference for equality in the U_2 class of welfare functions (for SSD), we can say that while the general *level* of incomes of single females improves with taxes and transfers, single males' incomes remain more equally distributed. This reflects the great disparity between the women in and out of the labor force, and their differing degrees of success in the labor force.

4.6 Test results for different cross sections

Table 7 ignores individual/group attributes. It provides the test results for a selection of years (1982, 1985, 1989 and 1992) which shed light on the movement of the overall income distributions over the time period in our sample frame. Depending on the economic conditions and income distribution policy, the time patterns of dominance might be different than the current one which is valid for non-consecutive selected years of observation.

Mean disposable income is seen to be increasing while its variance is also increasing. There is no monotone pattern to the corresponding values for gross incomes from 1982 to 1992.

In terms of gross incomes 1982 is first and second order dominated by all the other years. The dominance relation of later years over earlier periods holds with the exception of 1985 which second order dominates 1989. But, as can be seen from the disposable income distributions, taxes and transfers make 1982-1985 and 1982-1992 unrankable (maximal).

Indeed, 1982 second order dominates 1989. In terms of gross incomes, 1989 appears to be first or second order dominated by all the other years. 1992 is "better" in the SSD sense than both 1985 and 1989.

After taxes and transfers, 1989 remains the worst year, being first order dominated by both 1985 and 1992. In turn, 1992 and 1989 are almost maximal with 1992 being second order dominant only at about the 0.93 level.

4.7 Test results for marital status

Appendix A gives the results of our tests for grouping according to the "marital status" of the individuals. Although individuals are all singles we can distinguish a few groups which we expect to differ in their income distributions and well-being. The sample is divided into unmarried, females married but living separate from their husbands, divorced and widow/widower.

In terms of both types of incomes the divorced and widows/widowers are having a much higher income levels than the unmarried and married females that are living separately from their husbands. The unmarried group consists mainly of young individuals most of whom are students with small earnings. In terms of gross income the unmarried individuals are both first and second order dominated by the married not living with their husbands and the widow/widowers. Public transfers and taxes induce changes in the order of rankings. The unmarried dominates the divorced and widow/widowers in the second order sense. The married females not living with their husbands second order dominate the divorced and widow/widowers.

5. Summary and Conclusions

The potential for conducting meaningful statistical ranking of welfare situations is clearly very good. The bootstrap and other resampling tools can be profitably used in the difficult case of inequality restrictions, such as stochastic dominance relations, where even asymptotic approximations are difficult. The use of unrestricted bootstrap confidence intervals in our inferences is a useful innovation when it is difficult to impose the null restrictions in nonparametric settings. Statistical ranking is sound and, somewhat surprisingly, rather decisive in many cases.

In this paper we consider statistical test procedures for first and second order stochastic dominance. Previous studies suggests that bootstrap is an attractive alternative to the existing approximate asymptotic inference methods. This is further demonstrated with eleven waves of a panel and two income definitions in Sweden. One is gross income and the other is a disposable income. The comparison of the distribution of these two variables allows a partial look at the impact of Sweden's welfare system in this context. Several population subgroups are studied separately and in comparison with others. We have focused on single individual immigrants identified by country of origin, length of residency, age, education, gender, marital status and other characteristics.

Our results suggest that although the sample of singles studied is a small and relatively homogeneous segment of the population of individuals, we observe some clear heterogeneous patterns of economic well being. We find that first order dominance is rare, but second order dominance holds in several case comparisons. An extension of the sample to incorporate groups of individuals targeted for various tax and public transfer policy measures would shed additional light on the state of welfare of individuals and the impact of those policies implemented. This is important in the design and evaluation of welfare policies.

Taxes and public transfers are shown to be effective measures in reducing the variance of disposable income. Despite the high degree of equalization of incomes across various segments of population a large degree of inequality remains. The singles contribution to the welfare of households with children, specially the Lone Mothers and the aged population is an important corner stone in the Swedish welfare system.

A further significance of our results is that they allow a proper interpretation of inequality studies and impressions based on indices of inequality and mobility.

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Stochastic Dominance Amongst Swedish Income Distributions

List of Tables and Appendices:

Data and Definition of Variables:

Income: Non negative income.
Period: 1982-1992.
Sample: Single individuals with no children (single individual households).
Observations: 46672

Gross Income = (labor income + capital income + temporary employment + agriculture – losses)
Transfers = (base pension + additional pension + unemployment benefit + labor market training program benefit + housing/rent support benefits + social assistance benefit + student loans + etc ..)
Taxes = Total taxes
Disposable Income = (Gross Income + Transfers – Taxes)

Glossary of Tests:

FSDxoy	First order stochastic dominance x over y
FSDyox	First order stochastic dominance y over x
FOmax	First order maximal
SSDxoy	Second order stochastic dominance x over y
SSDyox	Second order stochastic dominance y over x
SOmax	Second order maximal
Probability	Reject the null of no dominance when the statistics are negative.

Table 1 Test for stochastic dominance of different age groups in same year.

	Gross Income			Disposable Income		
Year/Age	Observation	Mean	Std dev	Observation	Mean	Std dev
Mean and Std dev of income by age intervals in selection of years:						
1982, 20-30	1636	758.27	515.36	1636	594.98	351.48
1982, 31-40	1153	960.20	622.38	1153	702.81	373.17
1982, 41-55	664	932.03	734.59	664	726.46	358.56
1987, 20-30	1964	698.59	918.41	1964	633.62	386.54
1987, 31-40	1126	858.58	740.16	1126	739.47	426.58
1987, 41-55	1061	1064.65	1080.82	1061	860.37	502.49
1992, 20-30	2589	585.27	574.48	2589	715.41	392.99
1992, 31-40	2027	674.67	664.62	2027	923.16	516.94
1992, 41-55	2291	949.12	856.71	2291	983.68	507.86

Test	Mean	Std error	Probability	Mean	Std error	Probability
1982, 20-30(X) vs 31-40(Y):						
FSDxoy	0.0021	0.0026	0.2050	-0.0044	0.0022	0.9740
FSDyox	0.0262	0.0098	0.0030	0.0295	0.0098	0.0010
FOmax	0.0020	0.0024	0.2080	-0.0044	0.0022	0.9750
SSDxoy	-0.0209	0.0133	0.9650	-0.0280	0.0109	0.9920
SSDyox	0.1134	0.0508	0.0080	0.1554	0.0532	0.0030
SOmax	-0.0215	0.0111	0.9730	-0.0280	0.0105	0.9950
1982, 20-30(X) vs 41-55(Y):						
FSDxoy	0.0150	0.0084	0.0070	-0.0035	0.0030	0.8750
FSDyox	0.0054	0.0110	0.3260	0.0626	0.0114	0.0000
FOmax	0.0021	0.0075	0.3330	-0.0035	0.0030	0.8750
SSDxoy	0.0504	0.0603	0.2600	-0.0608	0.0124	1.0000
SSDyox	0.0173	0.0420	0.4480	0.3202	0.0621	0.0000
SOmax	-0.0077	0.0142	0.7080	-0.0608	0.0124	1.0000
1982, 31-40(X) vs 41-55(Y):						
FSDxoy	0.0282	0.0140	0.0050	0.0009	0.0029	0.4210
FSDyox	-0.0075	0.0065	0.8910	0.0343	0.0119	0.0000
FOmax	-0.0077	0.0061	0.8960	0.0009	0.0029	0.4210
SSDxoy	0.1459	0.0799	0.0160	-0.0326	0.0132	0.9950
SSDyox	-0.0262	0.0188	0.9550	0.1674	0.0629	0.0010
SOmax	-0.0273	0.0150	0.9710	-0.0327	0.0130	0.9960
1987, 20-30(X) vs 31-40(Y):						
FSDxoy	0.0010	0.0082	0.4390	0.0050	0.0049	0.1530
FSDyox	0.0157	0.0108	0.0700	0.0099	0.0092	0.1520
FOmax	-0.0008	0.0068	0.5090	0.0020	0.0041	0.3050
SSDxoy	-0.0033	0.0276	0.7310	0.0081	0.0339	0.5900
SSDyox	0.0794	0.0671	0.1100	0.0351	0.0372	0.1840
SOmax	-0.0116	0.0119	0.8410	-0.0079	0.0112	0.7740
1987, 20-30(X) vs 41-55(Y):						
FSDxoy	0.0069	0.0105	0.2550	0.0066	0.0058	0.1310
FSDyox	0.0477	0.0123	0.0000	0.0480	0.0096	0.0000
FOmax	0.0068	0.0103	0.2550	0.0065	0.0058	0.1310
SSDxoy	-0.0387	0.0177	0.9690	-0.0473	0.0125	0.9900
SSDyox	0.2009	0.0766	0.0000	0.1623	0.0472	0.0000
SOmax	-0.0387	0.0175	0.9690	-0.0473	0.0121	0.9900

Table 1 Continued ...

Test	Mean	Std error	Probability	Mean	Std error	Probability
1987, 31-40(X) vs 41-55(Y):						
FSDxoy	0.0085	0.0073	0.0880	0.0036	0.0052	0.2590
FSDyox	0.0344	0.0133	0.0050	0.0398	0.0109	0.0000
FOmax	0.0077	0.0065	0.0930	0.0035	0.0050	0.2590
SSDxoy	-0.0241	0.0299	0.8890	-0.0384	0.0160	0.9790
SSDyox	0.1358	0.0680	0.0110	0.1440	0.0547	0.0000
SOmax	-0.0271	0.0205	0.9000	-0.0388	0.0134	0.9790
1992, 20-30(X) vs 31-40(Y):						
FSDxoy	0.0038	0.0027	0.0420	0.0051	0.0039	0.0470
FSDyox	0.0176	0.0082	0.0090	0.0040	0.0064	0.3440
FOmax	0.0033	0.0020	0.0510	0.0006	0.0026	0.3910
SSDxoy	-0.0078	0.0142	0.8180	0.0216	0.0320	0.3530
SSDyox	0.0722	0.0433	0.0490	0.0107	0.0203	0.3700
SOmax	-0.0101	0.0094	0.8670	-0.0045	0.0074	0.7230
1992, 20-30(X) vs 41-55(Y):						
FSDxoy	0.0047	0.0018	0.0050	0.0044	0.0017	0.0070
FSDyox	0.0775	0.0092	0.0000	0.0465	0.0071	0.0000
FOmax	0.0047	0.0018	0.0050	0.0044	0.0017	0.0070
SSDxoy	-0.0769	0.0097	1.0000	-0.0465	0.0071	1.0000
SSDyox	0.3308	0.0442	0.0000	0.1546	0.0334	0.0000
SOmax	-0.0769	0.0097	1.0000	-0.0465	0.0071	1.0000
1992, 31-40(X) vs 41-55(Y):						
FSDxoy	0.0015	0.0025	0.2600	0.0024	0.0018	0.0840
FSDyox	0.0669	0.0109	0.0000	0.0433	0.0081	0.0000
FOmax	0.0015	0.0025	0.2600	0.0024	0.0018	0.0840
SSDxoy	-0.0669	0.0109	1.0000	-0.0433	0.0082	0.9990
SSDyox	0.2583	0.0500	0.0000	0.1622	0.0389	0.0000
SOmax	-0.0669	0.0109	1.0000	-0.0433	0.0082	0.9990

Table 2 Test for stochastic dominance of same age group in different years.

	Gross Income			Disposable Income		
Year/Age	Observation	Mean	Std dev	Observation	Mean	Std dev
Mean and Std dev of income by age intervals in selection of years:						
1982, 20-30	1636	758.27	515.36	1636	594.98	351.48
1987, 20-30	1964	698.59	918.41	1964	633.62	386.54
1992, 20-30	2589	585.27	574.48	2589	715.41	392.99
1982, 31-40	1153	960.20	622.38	1153	702.81	373.17
1987, 31-40	1126	858.58	740.16	1126	739.47	426.58
1992, 31-40	2027	674.67	664.62	2027	923.16	516.94
1982, 41-55	664	932.03	734.59	664	726.46	358.56
1987, 41-55	1061	1064.65	1080.82	1061	860.37	502.49
1992, 41-55	2291	949.12	856.71	2291	983.68	507.86

Test	Mean	Std error	Probability	Mean	Std error	Probability
20-30, 1982(X) vs 1987(Y):						
FSDxoy	0.0785	0.0108	0.0000	0.0053	0.0037	0.0640
FSDyox	-0.0156	0.0080	1.0000	0.0299	0.0093	0.0010
FOmax	-0.0156	0.0080	1.0000	0.0052	0.0037	0.0650
SSDxoy	0.4442	0.0764	0.0000	-0.0274	0.0157	0.9430
SSDyox	-0.0784	0.0108	1.0000	0.0984	0.0413	0.0010
SOmax	-0.0784	0.0108	1.0000	-0.0278	0.0138	0.9440
20-30, 1982(X) vs 1992(Y):						
FSDxoy	0.1432	0.0100	0.0000	0.0004	0.0025	0.4730
FSDyox	-0.0130	0.0016	1.0000	0.0302	0.0088	0.0000
FOmax	-0.0130	0.0016	1.0000	0.0004	0.0025	0.4730
SSDxoy	0.6961	0.0480	0.0000	-0.0299	0.0100	0.9910
SSDyox	-0.1432	0.0100	1.0000	0.1061	0.0410	0.0000
SOmax	-0.1432	0.0100	1.0000	-0.0299	0.0095	0.9910
20-30, 1987(X) vs 1992(Y):						
FSDxoy	0.0658	0.0107	0.0000	0.0022	0.0064	0.3840
FSDyox	0.0021	0.0077	0.3790	0.0067	0.0045	0.0230
FOmax	0.0021	0.0077	0.3790	0.0003	0.0042	0.4070
SSDxoy	0.2677	0.0642	0.0000	0.0112	0.0240	0.4290
SSDyox	-0.0656	0.0117	0.9970	0.0244	0.0358	0.3460
SOmax	-0.0656	0.0117	0.9970	-0.0052	0.0068	0.7750
31-40, 1982(X) vs 1987(Y):						
FSDxoy	0.0881	0.0135	0.0000	0.0157	0.0048	0.0000
FSDyox	-0.0123	0.0026	1.0000	0.0120	0.0114	0.1510
FOmax	-0.0123	0.0026	1.0000	0.0078	0.0073	0.1510
SSDxoy	0.4741	0.0672	0.0000	0.0542	0.0556	0.1940
SSDyox	-0.0880	0.0137	1.0000	0.0253	0.0275	0.1510
SOmax	-0.0880	0.0137	1.0000	0.0046	0.0176	0.3450
31-40, 1982(X) vs 1992(Y):						
FSDxoy	0.1552	0.0117	0.0000	0.0050	0.0049	0.1530
FSDyox	-0.0149	0.0023	1.0000	0.0099	0.0092	0.1520
FOmax	-0.0149	0.0023	1.0000	0.0020	0.0041	0.3050
SSDxoy	0.7391	0.0573	0.0000	0.0081	0.0339	0.5900
SSDyox	-0.1552	0.0117	1.0000	0.0351	0.0372	0.1840
SOmax	-0.1552	0.0117	1.0000	-0.0079	0.0112	0.7740

Table 2 Continued ...

Test	Mean	Std error	Probability	Mean	Std error	Probability
31-40, 1987(X) vs 1992(Y):						
FSDxoy	0.0660	0.0128	0.0000	0.0081	0.0088	0.1830
FSDyox	-0.0023	0.0027	0.7980	0.0068	0.0037	0.0120
FOmax	-0.0023	0.0027	0.7980	0.0029	0.0041	0.1950
SSDxoy	0.2570	0.0620	0.0000	0.0333	0.0373	0.2250
SSDyox	-0.0660	0.0128	1.0000	0.0096	0.0326	0.5390
SOmax	-0.0660	0.0128	1.0000	-0.0071	0.0100	0.7640
41-55, 1982(X) vs 1987(Y):						
FSDxoy	0.0358	0.0141	0.0000	0.0234	0.0072	0.0000
FSDyox	-0.0096	0.0073	0.9060	0.0170	0.0127	0.0940
FOmax	-0.0096	0.0071	0.9060	0.0126	0.0086	0.0940
SSDxoy	0.2273	0.0967	0.0050	0.0946	0.0685	0.0860
SSDyox	-0.0323	0.0171	0.9760	0.0276	0.0254	0.0940
SOmax	-0.0326	0.0163	0.9810	0.0146	0.0196	0.1800
41-55, 1982(X) vs 1992(Y):						
FSDxoy	0.0622	0.0142	0.0000	0.0180	0.0064	0.0010
FSDyox	-0.0073	0.0054	0.9150	0.0153	0.0111	0.0930
FOmax	-0.0073	0.0054	0.9150	0.0099	0.0064	0.0940
SSDxoy	0.3441	0.0805	0.0000	0.0774	0.0585	0.1010
SSDyox	-0.0621	0.0143	1.0000	0.0209	0.0194	0.0930
SOmax	-0.0621	0.0143	1.0000	0.0100	0.0158	0.1940
41-55, 1987(X) vs 1992(Y):						
FSDxoy	0.0296	0.0129	0.0080	0.0052	0.0078	0.2740
FSDyox	0.0035	0.0061	0.3020	0.0088	0.0055	0.0470
FOmax	0.0031	0.0056	0.3100	0.0019	0.0049	0.3210
SSDxoy	0.1269	0.0671	0.0090	0.0193	0.0293	0.3290
SSDyox	-0.0251	0.0233	0.9180	0.0290	0.0413	0.3570
SOmax	-0.0271	0.0169	0.9270	-0.0034	0.0097	0.6860

Table 3 Test for stochastic dominance of different levels of education.

	Gross Income			Disposable Income		
Education	Observation	Mean	Std dev	Observation	Mean	Std dev
Mean and Std dev of income by levels of education:						
Secondary	4982	702.43	628.79	4982	861.69	442.58
High School	7856	833.12	686.96	7856	849.01	425.28
University	2540	1147.85	1938.37	2540	1010.51	841.38

Test	Mean	Std error	Probability	Mean	Std error	Probability
Secondary(X) vs High School(Y):						
FSDxoy	0.0008	0.0015	0.3160	-0.0004	0.0024	0.6830
FSDyox	0.0641	0.0059	0.0000	0.0074	0.0030	0.0030
FOmax	0.0008	0.0015	0.3160	-0.0006	0.0019	0.6860
SSDxoy	-0.0641	0.0059	1.0000	-0.0020	0.0048	0.7110
SSDyox	0.2485	0.0285	0.0000	0.0414	0.0217	0.0320
SOmax	-0.0641	0.0059	1.0000	-0.0026	0.0040	0.7430
Secondary(X) vs University(Y):						
FSDxoy	0.0316	0.0103	0.0000	0.0244	0.0065	0.0000
FSDyox	0.0487	0.0089	0.0000	-0.0108	0.0051	0.9790
FOmax	0.0300	0.0081	0.0000	-0.0108	0.0051	0.9790
SSDxoy	0.0434	0.0753	0.3270	0.1806	0.0504	0.0000
SSDyox	0.0928	0.0289	0.0000	-0.0117	0.0059	0.9790
SOmax	0.0219	0.0463	0.3270	-0.0117	0.0059	0.9790
High School(X) vs University(Y):						
FSDxoy	0.0446	0.0106	0.0000	0.0306	0.0062	0.0000
FSDyox	-0.0143	0.0068	0.9750	-0.0134	0.0049	0.9960
FOmax	-0.0143	0.0068	0.9750	-0.0134	0.0049	0.9960
SSDxoy	0.2889	0.0762	0.0000	0.2238	0.0492	0.0000
SSDyox	-0.0157	0.0081	0.9750	-0.0144	0.0055	0.9960
SOmax	-0.0157	0.0081	0.9750	-0.0144	0.0055	0.9960

Table 4 Test for stochastic dominance of different immigration years to Sweden.

	Gross Income			Disposable Income		
Immig. year	Observation	Mean	Std dev	Observation	Mean	Std dev
Mean and Std dev of income byyear of immigration:						
1968	4469	995.93	681.98	4469	826.33	382.91
1974	4445	865.74	701.38	4445	756.18	413.60
1983	3817	711.54	682.03	3817	697.87	439.68
1989	5088	631.51	617.66	5088	758.95	427.81

Test	Mean	Std error	Probability	Mean	Std error	Probability
1968(X) vs 1974(Y):						
FSDxoy	0.0497	0.0066	0.0000	0.0408	0.0050	0.0000
FSDyox	-0.0081	0.0017	1.0000	-0.0050	0.0014	1.0000
FOmax	-0.0081	0.0017	1.0000	-0.0050	0.0014	1.0000
SSDxoy	0.2810	0.0354	0.0000	0.2166	0.0276	0.0000
SSDyox	-0.0495	0.0068	1.0000	-0.0408	0.0050	1.0000
SOmax	-0.0495	0.0068	1.0000	-0.0408	0.0050	1.0000
1968(X) vs 1983(Y):						
FSDxoy	0.1130	0.0072	0.0000	0.0833	0.0056	0.0000
FSDyox	-0.0117	0.0019	1.0000	-0.0086	0.0015	1.0000
FOmax	-0.0117	0.0019	1.0000	-0.0086	0.0015	1.0000
SSDxoy	0.5860	0.0355	0.0000	0.4438	0.0291	0.0000
SSDyox	-0.1130	0.0072	1.0000	-0.0833	0.0056	1.0000
SOmax	-0.1130	0.0072	1.0000	-0.0833	0.0056	1.0000
1968(X) vs 1989(Y):						
FSDxoy	0.1606	0.0068	0.0000	0.0571	0.0049	0.0000
FSDyox	-0.0083	0.0014	1.0000	-0.0033	0.0013	0.9960
FOmax	-0.0083	0.0014	1.0000	-0.0033	0.0013	0.9960
SSDxoy	0.7290	0.0333	0.0000	0.2971	0.0261	0.0000
SSDyox	-0.1606	0.0068	1.0000	-0.0570	0.0049	1.0000
SOmax	-0.1606	0.0068	1.0000	-0.0570	0.0049	1.0000
1974(X) vs 1983(Y):						
FSDxoy	0.0634	0.0076	0.0000	0.0425	0.0060	0.0000
FSDyox	-0.0037	0.0019	0.9780	-0.0037	0.0014	0.9950
FOmax	-0.0037	0.0019	0.9780	-0.0037	0.0014	0.9950
SSDxoy	0.3048	0.0375	0.0000	0.2279	0.0304	0.0000
SSDyox	-0.0634	0.0076	1.0000	-0.0425	0.0060	1.0000
SOmax	-0.0634	0.0076	1.0000	-0.0425	0.0060	1.0000
1974(X) vs 1989(Y):						
FSDxoy	0.1112	0.0070	0.0000	0.0168	0.0051	0.0000
FSDyox	-0.0003	0.0014	0.5930	0.0017	0.0013	0.0970
FOmax	-0.0003	0.0014	0.5930	0.0017	0.0013	0.0970
SSDxoy	0.4490	0.0341	0.0000	0.0829	0.0270	0.0000
SSDyox	-0.1112	0.0070	1.0000	-0.0162	0.0056	0.9970
SOmax	-0.1112	0.0070	1.0000	-0.0162	0.0056	0.9970
1983(X) vs 1989(Y):						
FSDxoy	0.0475	0.0078	0.0000	-0.0053	0.0013	1.0000
FSDyox	0.0034	0.0017	0.0160	0.0264	0.0061	0.0000
FOmax	0.0034	0.0017	0.0160	-0.0053	0.0013	1.0000
SSDxoy	0.1488	0.0338	0.0000	-0.0263	0.0062	1.0000
SSDyox	-0.0474	0.0080	1.0000	0.1476	0.0308	0.0000
SOmax	-0.0474	0.0080	1.0000	-0.0263	0.0062	1.0000

Table 5 Test for stochastic dominance of different countries of origin.

	Gross Income			Disposable Income		
Country	Observation	Mean	Std dev	Observation	Mean	Std dev
Mean and Std dev of income by country of origin:						
Sweden	4742	1086.87	2098.56	4742	833.31	771.45
Other Nordic	18146	964.77	653.38	18146	805.50	379.66
Europe	11079	759.55	725.52	11079	689.77	453.26
Other Countries	12705	609.05	565.56	12705	713.91	404.61

Test	Mean	Std error	Probability	Mean	Std error	Probability
Sweden(X) vs Other Nordic(Y):						
FSDxoy	-0.0328	0.0020	1.0000	-0.0251	0.0032	1.0000
FSDyox	0.0940	0.0085	0.0000	0.0678	0.0044	0.0000
FOmax	-0.0328	0.0020	1.0000	-0.0251	0.0032	1.0000
SSDxoy	-0.0702	0.0060	1.0000	-0.0557	0.0041	1.0000
SSDyox	0.6930	0.0585	0.0000	0.4944	0.0353	0.0000
SOmax	-0.0702	0.0060	1.0000	-0.0557	0.0041	1.0000
Sweden(X) vs Europe(Y):						
FSDxoy	0.0444	0.0069	0.0000	0.0364	0.0052	0.0000
FSDyox	0.0390	0.0083	0.0000	0.0178	0.0045	0.0000
FOmax	0.0357	0.0056	0.0000	0.0178	0.0045	0.0000
SSDxoy	0.0714	0.0192	0.0000	0.0705	0.0170	0.0000
SSDyox	0.0992	0.0622	0.0550	0.0061	0.0360	0.4780
SOmax	0.0513	0.0241	0.0550	0.0032	0.0309	0.4780
Sweden(X) vs Other Countries(Y):						
FSDxoy	0.0531	0.0067	0.0000	-0.0105	0.0046	0.9840
FSDyox	0.0426	0.0082	0.0000	0.0330	0.0050	0.0000
FOmax	0.0408	0.0063	0.0000	-0.0105	0.0046	0.9840
SSDxoy	0.1071	0.0237	0.0000	-0.0105	0.0047	0.9840
SSDyox	0.0641	0.0615	0.1610	0.2279	0.0389	0.0000
SOmax	0.0476	0.0419	0.1610	-0.0105	0.0047	0.9840
Other Nordic(X) vs Europe(Y):						
FSDxoy	0.1148	0.0040	0.0000	0.0923	0.0034	0.0000
FSDyox	-0.0144	0.0009	1.0000	-0.0103	0.0007	1.0000
FOmax	-0.0144	0.0009	1.0000	-0.0103	0.0007	1.0000
SSDxoy	0.5973	0.0197	0.0000	0.4924	0.0171	0.0000
SSDyox	-0.1148	0.0040	1.0000	-0.0923	0.0034	1.0000
SOmax	-0.1148	0.0040	1.0000	-0.0923	0.0034	1.0000
Other Nordic(X) vs Other Countries(Y):						
FSDxoy	0.1234	0.0037	0.0000	0.0454	0.0027	0.0000
FSDyox	-0.0086	0.0008	1.0000	-0.0056	0.0007	1.0000
FOmax	-0.0086	0.0008	1.0000	-0.0056	0.0007	1.0000
SSDxoy	0.6317	0.0182	0.0000	0.2680	0.0146	0.0000
SSDyox	-0.1234	0.0037	1.0000	-0.0453	0.0027	1.0000
SOmax	-0.1234	0.0037	1.0000	-0.0453	0.0027	1.0000
Europe(X) vs Other Countries(Y):						
FSDxoy	0.0140	0.0038	0.0000	-0.0047	0.0008	1.0000
FSDyox	0.0062	0.0012	0.0000	0.0468	0.0037	0.0000
FOmax	0.0061	0.0012	0.0000	-0.0047	0.0008	1.0000
SSDxoy	0.0510	0.0177	0.0000	-0.0468	0.0037	1.0000
SSDyox	-0.0081	0.0061	0.9480	0.2233	0.0189	0.0000
SOmax	-0.0082	0.0054	0.9480	-0.0468	0.0037	1.0000

Table 6 Test for stochastic dominance by sex of individuals.

	Gross Income			Disposable Income		
Sex	Observation	Mean	Std dev	Observation	Mean	Std dev
Mean and Std dev of income by Sex:						
Male	26434	854.40	1072.56	26434	726.02	462.62
Female	20238	801.88	681.47	20238	794.98	456.91
Test	Mean	Std error	Probability	Mean	Std error	Probability
Male(X) vs Female(Y):						
FSDxoy	-0.0085	0.0019	1.0000	-0.0012	0.0013	0.8210
FSDyox	0.0286	0.0027	0.0000	0.0258	0.0023	0.0000
FOmax	-0.0085	0.0019	1.0000	-0.0012	0.0013	0.8210
SSDxoy	-0.0213	0.0032	1.0000	-0.0257	0.0023	1.0000
SSDyox	0.1913	0.0211	0.0000	0.1041	0.0138	0.0000
SOmax	-0.0213	0.0032	1.0000	-0.0257	0.0023	1.0000

Table 7 Test for stochastic dominance of different years of observation.

	Gross Income			Disposable Income		
Year of obs	Observation	Mean	Std dev	Observation	Mean	Std dev
Mean and Std dev of income by Years of observation:						
1982	3452	859.14	606.62	3452	656.29	364.87
1985	3355	778.53	729.03	3355	684.40	391.40
1989	3662	945.37	1001.40	3662	743.50	392.18
1992	6907	732.19	722.02	6907	865.36	485.65

Test	Mean	Std error	Probability	Mean	Std error	Probability
1982(X) vs 1985(Y):						
FSDxoy	0.0610	0.0077	0.0000	0.0092	0.0025	0.0000
FSDyox	-0.0103	0.0031	1.0000	0.0178	0.0067	0.0040
FOmax	-0.0103	0.0031	1.0000	0.0085	0.0023	0.0040
SSDxoy	0.3301	0.0433	0.0000	0.0000	0.0264	0.5950
SSDyox	-0.0610	0.0077	1.0000	0.0426	0.0215	0.0040
SOmax	-0.0610	0.0077	1.0000	-0.0054	0.0174	0.5990
1982(X) vs 1989(Y):						
FSDxoy	0.0356	0.0071	0.0000	0.0028	0.0015	0.0370
FSDyox	-0.0131	0.0042	1.0000	0.0322	0.0064	0.0000
FOmax	-0.0131	0.0042	1.0000	0.0028	0.0015	0.0370
SSDxoy	0.2409	0.0480	0.0000	-0.0322	0.0064	1.0000
SSDyox	-0.0352	0.0074	1.0000	0.1155	0.0299	0.0000
SOmax	-0.0352	0.0074	1.0000	-0.0322	0.0064	1.0000
1982(X) vs 1992(Y):						
FSDxoy	0.1241	0.0067	0.0000	0.0102	0.0024	0.0000
FSDyox	-0.0134	0.0018	1.0000	0.0239	0.0057	0.0000
FOmax	-0.0134	0.0018	1.0000	0.0101	0.0023	0.0000
SSDxoy	0.6076	0.0345	0.0000	0.0007	0.0249	0.5140
SSDyox	-0.1241	0.0067	1.0000	0.0463	0.0161	0.0000
SOmax	-0.1241	0.0067	1.0000	-0.0019	0.0207	0.5140
1985(X) vs 1989(Y):						
FSDxoy	0.0033	0.0053	0.2640	-0.0038	0.0019	0.9710
FSDyox	0.0256	0.0078	0.0010	0.0156	0.0052	0.0000
FOmax	0.0031	0.0050	0.2650	-0.0038	0.0019	0.9710
SSDxoy	-0.0230	0.0151	0.9460	-0.0139	0.0063	0.9880
SSDyox	0.0982	0.0425	0.0010	0.1025	0.0330	0.0020
SOmax	-0.0237	0.0120	0.9470	-0.0139	0.0062	0.9900
1985(X) vs 1992(Y):						
FSDxoy	0.0624	0.0072	0.0000	0.0042	0.0036	0.1150
FSDyox	-0.0031	0.0028	0.8600	0.0068	0.0049	0.0590
FOmax	-0.0031	0.0028	0.8600	0.0021	0.0022	0.1740
SSDxoy	0.2739	0.0392	0.0000	0.0097	0.0221	0.4320
SSDyox	-0.0624	0.0072	1.0000	0.0135	0.0154	0.1350
SOmax	-0.0624	0.0072	1.0000	-0.0030	0.0075	0.5670
1989(X) vs 1992(Y):						
FSDxoy	0.0883	0.0070	0.0000	0.0176	0.0038	0.0000
FSDyox	-0.0000	0.0041	0.5340	-0.0023	0.0019	0.9050
FOmax	-0.0000	0.0041	0.5340	-0.0023	0.0019	0.9050
SSDxoy	0.3652	0.0444	0.0000	0.1073	0.0277	0.0000
SSDyox	-0.0883	0.0070	1.0000	-0.0079	0.0052	0.9320
SOmax	-0.0883	0.0070	1.0000	-0.0079	0.0052	0.9320

Appendix A Test for stochastic dominance of different marital status.

	Gross Income			Disposable Income		
Marital	Observation	Mean	Std dev	Observation	Mean	Std dev
Mean and Std dev of income by Marital Status:						
Unmarried	28585	792.47	765.69	28585	696.88	395.84
Not living with husband	2410	639.16	656.66	2410	754.21	487.38
Divorced	14568	938.28	1195.02	14568	859.42	545.92
Widow/Widower	1109	858.08	920.27	1109	922.03	482.38

Test	Mean	Std error	Probability	Mean	Std error	Probability
Unmarried(X) vs Married not living with husband(Y):						
FSDxoy	0.0952	0.0075	0.0000	0.0361	0.0058	0.0000
FSDyox	-0.0075	0.0015	1.0000	-0.0063	0.0012	1.0000
FOmax	-0.0075	0.0015	1.0000	-0.0063	0.0012	1.0000
SSDxoy	0.4091	0.0357	0.0000	0.2367	0.0304	0.0000
SSDyox	-0.0952	0.0075	1.0000	-0.0359	0.0062	1.0000
SOmax	-0.0952	0.0075	1.0000	-0.0359	0.0062	1.0000
Unmarried(X) vs Divorced(Y):						
FSDxoy	0.0159	0.0034	0.0000	0.0078	0.0017	0.0000
FSDyox	0.0134	0.0035	0.0000	0.0301	0.0025	0.0000
FOmax	0.0120	0.0025	0.0000	0.0078	0.0017	0.0000
SSDxoy	0.0221	0.0267	0.2400	-0.0295	0.0043	0.9990
SSDyox	0.0371	0.0131	0.0000	0.0767	0.0102	0.0000
SOmax	0.0126	0.0157	0.2400	-0.0295	0.0043	0.9990
Unmarried(X) vs Widow/Widower(Y):						
FSDxoy	0.0493	0.0091	0.0000	0.0072	0.0031	0.0070
FSDyox	-0.0121	0.0014	1.0000	0.0492	0.0064	0.0000
FOmax	-0.0121	0.0014	1.0000	0.0072	0.0031	0.0070
SSDxoy	0.3443	0.0541	0.0000	-0.0478	0.0105	0.9890
SSDyox	-0.0480	0.0105	1.0000	0.1102	0.0250	0.0000
SOmax	-0.0480	0.0105	1.0000	-0.0478	0.0105	0.9890
Married not living with husband(X) vs Divorced(Y):						
FSDxoy	0.0047	0.0024	0.0120	-0.0002	0.0017	0.5750
FSDyox	0.1068	0.0079	0.0000	0.0657	0.0062	0.0000
FOmax	0.0047	0.0024	0.0120	-0.0002	0.0017	0.5750
SSDxoy	-0.1068	0.0079	1.0000	-0.0657	0.0062	1.0000
SSDyox	0.3914	0.0399	0.0000	0.2859	0.0318	0.0000
SOmax	-0.1068	0.0079	1.0000	-0.0657	0.0062	1.0000
Married not living with husband(X) vs Widow/Widower(Y):						
FSDxoy	0.0140	0.0050	0.0010	-0.0033	0.0018	0.9710
FSDyox	0.0478	0.0131	0.0000	0.0856	0.0086	0.0000
FOmax	0.0139	0.0048	0.0010	-0.0033	0.0018	0.9710
SSDxoy	-0.0360	0.0327	0.8630	-0.0856	0.0086	1.0000
SSDyox	0.1127	0.0451	0.0000	0.3261	0.0451	0.0000
SOmax	-0.0374	0.0285	0.8630	-0.0856	0.0086	1.0000
Divorced(X) vs Widow/Widower(Y):						
FSDxoy	0.0592	0.0107	0.0000	0.0009	0.0041	0.4370
FSDyox	0.0002	0.0025	0.4940	0.0193	0.0062	0.0010
FOmax	0.0002	0.0025	0.4940	0.0008	0.0039	0.4380
SSDxoy	0.3196	0.0591	0.0000	-0.0131	0.0169	0.8290
SSDyox	-0.0591	0.0109	1.0000	0.0453	0.0286	0.0010
SOmax	-0.0591	0.0109	1.0000	-0.0148	0.0127	0.8300

Appendix B Summary statistics of the Swedish income data (in 1990 prices).

Variable	OBS	Definitions	Mean	Std Dev	Minimum	Maximum
YEAR	46672	Year of observation	1987.96	3.22	1982.00	1992.00
IMMIGR	41930	Immigration year	1978.63	6.59	1968.00	1989.00
NT	46672	No of times observed	7.55	3.29	1.00	11.00
AGE	46672	Age	33.79	9.80	20.00	55.00
SEX	46672	Sex (Male=1)	0.57	0.50	0.00	1.00
INCOME	46672	Gross Income	831.62	923.90	0.00	70237.00
TRANSF	46672	Transfers	218.87	335.03	0.00	4073.13
TAX	46672	Taxes	294.57	535.40	0.00	51779.00
DSPINC	46672	Disposable Income	755.92	461.42	0.00	19926.87
INCOME0	46672	Non-zero incomes	0.87	0.34	0.00	1.00
TAX0	46672	Non-zero taxes	0.85	0.36	0.00	1.00

Incomes, taxes and transfers are measured in 100 SEK.

Appendix C Summary statistics by various individual characteristics.

			Gross Income		Transfers		Taxes		Disposable income	
Charact. Var.	obs	non-zero	mean	std dev	mean	std dev	mean	std dev	mean	std dev
A. Mean and Std dev by year:										
1982	3452	0.90	859	607	86	196	289	288	656	365
1983	2737	0.89	809	833	167	263	283	499	693	381
1984	2679	0.87	806	763	172	261	294	412	685	366
1985	3355	0.85	779	729	166	259	260	372	684	391
1986	3163	0.85	846	877	164	263	297	517	712	406
1987	4151	0.85	836	932	184	287	299	547	720	440
1988	3894	0.88	911	1192	174	280	358	817	727	429
1989	3662	0.88	945	1001	171	288	373	713	743	392
1990	5448	0.86	893	1216	167	280	330	798	731	465
1991	7224	0.87	801	930	317	405	255	366	862	593
1992	6907	0.85	732	722	384	441	251	253	865	486
B. Mean and Std dev by Age:										
20	2112	0.89	569	468	119	191	167	163	521	293
21	2100	0.89	626	500	163	235	195	178	593	303
22	2089	0.89	691	541	174	251	222	204	642	317
23	2048	0.89	745	898	178	262	249	584	674	362
24	1965	0.89	756	1360	189	276	261	957	684	456
25	1853	0.89	752	804	192	278	256	553	688	355
26	1852	0.87	753	696	190	293	255	433	688	373
27	1775	0.86	749	607	200	313	248	216	701	393
28	1674	0.85	753	613	198	305	251	224	699	394
29	1597	0.85	759	626	208	323	262	243	705	399
30	1528	0.83	767	660	218	342	270	287	715	408
31	1480	0.84	777	671	213	330	273	307	716	409
32	1498	0.84	762	632	235	353	265	244	732	420
33	1430	0.84	788	652	241	381	274	260	755	446
34	1359	0.85	815	809	240	363	290	364	765	496
35	1273	0.85	799	685	244	353	281	275	762	439
36	1269	0.87	846	705	246	376	302	303	789	450
37	1324	0.87	854	690	270	384	308	297	816	450
38	1272	0.86	875	753	277	393	315	339	837	472
39	1223	0.86	881	757	274	398	322	325	834	458
40	1151	0.87	979	1388	268	394	361	692	886	702
41	1130	0.87	962	758	266	389	344	321	884	447
42	1124	0.87	1009	854	244	359	361	370	893	505
43	1139	0.88	973	770	244	369	351	326	865	449
44	1078	0.88	989	790	248	380	357	339	881	466
45	1032	0.86	1003	808	248	380	369	343	883	456
46	997	0.87	1068	1212	238	367	402	480	903	769
47	897	0.87	1070	964	227	357	404	477	894	496
48	852	0.89	1104	1379	218	340	420	868	902	569
49	807	0.88	1102	1106	228	364	418	660	913	494
50	739	0.86	1029	1064	233	349	394	631	868	463
51	695	0.86	1017	1405	248	371	397	932	868	518
52	641	0.85	983	1215	258	380	373	704	867	543
53	597	0.81	964	1266	266	371	392	930	838	434
54	546	0.81	949	1637	273	373	397	1349	825	447
55	526	0.80	1023	3148	280	373	458	2276	845	884
C. Mean and Std dev by Sex:										
Male	26434	0.86	854	1073	186	296	314	674	726	463
Female	20238	0.87	802	681	262	376	269	256	795	457

Appendix C Continued ...

			Gross Income		Transfers		Taxes		Disposable income	
Charact. var	obs	non-zero	mean	std dev	mean	std dev	mean	std dev	mean	std dev
D. Mean and Std dev by immigration:										
1968	4469	0.92	996	682	182	309	352	279	826	383
1971	4959	0.91	891	628	194	307	315	259	770	359
1974	4445	0.88	866	701	198	308	307	302	756	414
1977	6979	0.87	814	663	200	312	285	264	730	411
1980	6964	0.88	844	657	174	285	287	277	730	407
1983	3817	0.81	712	682	234	350	248	307	698	440
1986	5209	0.82	663	633	288	381	230	247	720	434
1989	5088	0.79	632	618	342	432	215	208	759	428
E. Mean and Std dev by Country:										
E1. Sweden:										
Sweden	4742	0.91	1087	2099	173	276	427	1468	833	771
E2. Other Nordic countries:										
Denmark	1840	0.92	1006	740	163	293	344	337	825	430
Norway	2331	0.89	943	669	138	276	320	282	761	411
Finland	13975	0.92	963	638	184	309	337	257	810	366
E3. East European countries:										
East Europe	811	0.75	627	724	299	415	226	304	700	515
Greece	1058	0.70	497	555	150	292	188	235	459	395
Polen	1848	0.86	811	741	269	355	286	324	793	432
Hungary	728	0.88	832	624	211	297	284	267	759	372
Sovjet	295	0.84	948	987	267	314	349	423	867	520
Yugoslavia	1994	0.82	746	620	252	374	278	248	720	396
E.4 West European countries:										
West Europe	1779	0.85	810	739	144	269	270	295	684	480
Germany	987	0.85	922	716	100	216	311	288	711	452
E.5 South European countries:										
South Europe	836	0.79	754	790	145	271	270	383	629	455
E.6 Middle East and North African countries:										
Arab countries	1595	0.79	551	559	312	395	206	205	657	401
Etiopia	754	0.88	585	489	381	393	199	165	766	366
Irak	537	0.84	569	559	399	369	219	196	750	315
Iran	2275	0.79	457	522	423	377	164	193	716	382
Other Asian	2279	0.84	720	606	188	322	239	233	669	413
Turkey	1049	0.80	573	539	285	391	209	202	649	424
E.7 North and South American, Australia, New Zealand countries:										
Chile	2166	0.89	726	559	334	398	237	195	823	387
Latin America	1362	0.80	599	559	272	339	196	203	675	424
Suhsahara	688	0.82	641	586	315	439	222	213	734	459
Canada/Aust/NewZ.	179	0.66	576	639	87	201	168	203	495	498
USA	564	0.77	752	958	143	277	285	543	610	472

Appendix C Continued ....

			Gross Income		Transfers		Taxes		Disposable income	
Charact. var	obs	non-zero	mean	std dev	mean	std dev	mean	std dev	mean	std dev
F. Mean and Std dev by Marital status:										
Unmarried	28585	0.87	792	766	175	284	271	417	697	396
Not living with husb.	2410	0.78	639	657	336	436	221	244	754	487
Divorced	14568	0.87	938	1195	266	380	344	738	859	546
Widow/Widower	1109	0.85	858	920	478	397	414	479	922	482
G. Mean and Std dev by Education:[1]										
Secondary <9 years	2265	0.83	726	664	459	513	257	216	928	451
Secondary 9-10	2717	0.86	683	597	350	422	227	198	807	428
High school 9-11	5061	0.92	857	620	289	377	278	197	867	410
High school 9-12	2795	0.91	790	793	289	367	263	412	816	449
University <3 years	1445	0.93	902	792	311	361	297	297	917	479
University >3	1016	0.93	1395	1876	234	325	513	864	1115	1039
PhD	79	0.91	2461	7826	138	347	1230	5781	1369	2081
H. Overall Sample Mean and Std dev:										
Sample	46672	0.87	832	924	219	335	295	535	756	461

1 The panel for education is based on 15385 observation, while the reminder panels are based on 46672 observations. Information on education was available only for the period 1990-1992.

Appendix D An illustration of the bootstrap results, 20-30 (X) vs 31-40 (Y).

Group	Age interval	Obs.	Mean	Std dev.
A. Gross Income in 1982:				
X	20-30	1636	758.2703	515.3580
Y	31-40	1153	960.2038	622.3815

Quintile	f(x)	F1(q)	Sum F1(q)	g(y)	F2(q)	Sum F2(q)
B. Sampling distribution for actual data:						
1	0.3700	0.3700	0.3700	0.3486	0.3486	0.3486
2	0.1180	0.4880	0.8581	0.1136	0.4622	0.8109
3	0.0905	0.5785	1.4366	0.0919	0.5542	1.3651
4	0.0776	0.6562	2.0929	0.0832	0.6374	2.0026
5	0.0697	0.7259	2.8189	0.0763	0.7137	2.7163
6	0.0642	0.7902	3.6091	0.0702	0.7840	3.5004
7	0.0605	0.8507	4.4599	0.0650	0.8490	4.3495
8	0.0562	0.9070	5.3669	0.0598	0.9089	5.2584
9	0.0513	0.9584	6.3253	0.0511	0.9601	6.2185
10	0.0415	1.0000	7.3253	0.0398	1.0000	7.2185

Quintile	F1(q)	Std error	F2(q)	Std error	Mean(F1-F2)	Std error	Pr[(F1-F2)<0]
C. Bootstrap results for Stochastic Dominance Test of X over Y:							
1	0.3704	0.0074	0.3490	0.0085	0.0213	0.0113	0.0280
2	0.4880	0.0067	0.4624	0.0078	0.0256	0.0101	0.0060
3	0.5790	0.0058	0.5544	0.0068	0.0245	0.0088	0.0030
4	0.6564	0.0049	0.6371	0.0058	0.0192	0.0076	0.0050
5	0.7259	0.0041	0.7132	0.0050	0.0126	0.0064	0.0260
6	0.7901	0.0034	0.7841	0.0040	0.0059	0.0052	0.1250
7	0.8505	0.0026	0.8490	0.0032	0.0014	0.0042	0.3680
8	0.9069	0.0020	0.9084	0.0023	-0.0014	0.0030	0.6890
9	0.9583	0.0013	0.9598	0.0014	-0.0014	0.0020	0.7630
10	1.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000

Quintile	Sum F1(q)	Std error	Sum F2(q)	Std error	Mean Sum(F1-F2)	Std error	Pr[sum (F1-F2)<0]
1	0.3704	0.0074	0.3490	0.0085	0.0213	0.0113	0.0280
2	0.8584	0.0140	0.8114	0.0162	0.0470	0.0213	0.0140
3	1.4374	0.0197	1.3659	0.0229	0.0715	0.0299	0.0080
4	2.0938	0.0245	2.0030	0.0286	0.0908	0.0372	0.0080
5	2.8198	0.0285	2.7162	0.0334	0.1035	0.0433	0.0100
6	3.6099	0.0316	3.5004	0.0371	0.1095	0.0481	0.0110
7	4.4605	0.0340	4.3495	0.0399	0.1110	0.0518	0.0150
8	5.3674	0.0357	5.2579	0.0417	0.1095	0.0542	0.0210
9	6.3258	0.0366	6.2177	0.0426	0.1080	0.0554	0.0240
10	7.3258	0.0366	7.2177	0.0426	0.1080	0.0550	0.0240
D. Stochastic Dominance Tests:							
FSDxoy	0.0021	0.0026	0.2050				
FSDyox	0.0261	0.0097	0.0030				
FOmax	0.0020	0.0024	0.2080				
SSDxoy	-0.0209	0.0132	0.9650				
SSDyox	0.1133	0.0507	0.0080				
SOmax	-0.0215	0.0111	0.9730				

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