Polarization, growth and social policy

The case of Israel, 1997 to 2006

by

Rosa María García-Fernández[*]

Daniel Gottlieb[**]

Federico Palacios-González[*]

Abstract

We apply a methodology developed by García-Fernández and Palacios-González (2008a,b) to the measurement of income polarization using Israeli data over the past decade. During this period the Israeli economy experienced sharp economic fluctuations, from rapid growth to a severe recession and back to rapid growth during four and a half years. During and at the end of the recession a deep and permanent cut in social benefits was carried out, accompanied by small scale proactive labor market policy. The largely export-led growth period thereafter was mainly concentrated in hi-tech industries, to the advantage of the high-skilled labor force. Such a development is expected to have a destabilizing effect on social stability as captured in polarization measures. Nevertheless, the values of the suggested measure indicate that polarization fluctuated around a horizontal trend during the period considered.

Keywords: Polarization, Poverty, Multiresolution analysis.

JEL Classification codes: H54, I21, I3, J1, O15, O53

[*] University of Granada, Spain
[**] National Insurance Institute and Ben-Gurion University, Israel

1.INTRODUCTION

The question concerning income class structures was a natural one to ask among 19th century economists. However, since then it had been relegated to books of the history of economic thought. In recent years this issue has been rediscovered, with a growing number of scholars defining a methodology that allows for a more continuous measurement of this inherently polar issue. The new indicators thus measure the degree of polarization in a society. While earlier approaches were somewhat richer in their identification of the underlying causes of polarization, relating it to the theory of value, to land, capital and the human resource, today the focus is mainly on polarization of income, although there may also be important cultural forces at work, that manage to marginalize minorities in a political process.[1] The theoretical underpinnings of polarization have been analyzed by Esteban and Ray, 1994, and by Wolfson, 1994 among others. While income distribution has been widely discussed, an interesting question is whether there are forces in the economy, that evoke the formation of income class patterns. Part of the renewed interest in the question of income distribution relates to globalization, which appears to be a powerful redistributing force of world income.[2]

During the observation period the Israeli economy experienced sharp economic fluctuations from rapid growth to a severe recession and back to a quick turnaround followed by a growth period of four and a half years. During and immediately after the recession two consecutive governments carried out an aggressive social policy, cutting deeply into social security and income support benefits, and began a relatively small scale pilot of proactive labor market policy. The largely export-led growth period thereafter was mainly concentrated in hi-tech industries, thus benefiting mainly the high skilled labor force. Such an extreme development may be expected to have a destabilizing effect on social stability as captured by polarization measures. Nonetheless, the values of the measure proposed as well as the measure defined by Duclos, Esteban and Ray (2004), fluctuated around a trend that can be considered horizontal[3]. However, one may argue that polarization in itself is a neutral phenomenon, the implications of which may differ from case to case with respect to inequality and poverty. Imagine a society in which poverty has been eradicated. The polarization issue may still be a very relevant one, focusing for example on the extremely rich and the resulting concentration of political power.

---

[1] See also Alesina and Glaeser, 2004.

[2] See Duro, 2005 or Burtless, 2007.

[3] The linear trend has negative estimated slope close to zero if we include the year 1997, and it has positive estimated slope also close to zero if we do not consider that same year. In no case the significance test rejects the null hypothesis of null slope. Hence the data does not show evidence about a slope distinct to zero for this trend.

The polarization indicator used here avoids social weighting and concentrates on the purely positive aspect of polarization. It was developed by Fernandez and Palacios (2008b) and is applied here to the measurement of income polarization for Israeli data over the past decade. The methodology for polarization measurement is presented in the first section. In the second section the data base is described. Relevant stylized facts about the Israeli economy are presented in the third section. The calculations of polarization and their implications in the highly heterogeneous socio-economic context and particular radical social policy environment are discussed in section 4. Preliminary conclusions are drawn in the last section.

2.STATISTICAL APPROACH

2.1 The model

To model the income distribution we are going to use a family of density functions based on multiresolution analysis (MRA henceforth) that provides an easy way to detect sub-populations (Palacios and Garcia, 2007). The features of the MRA model make it especially useful to study polarization. It allows us to identify, by its own method of estimation, those sub-populations whose incomes are concentrated around poles; as a consequence the number of poles can be established from the income distribution. This is especially useful when the number of poles cannot be determined exogenously according to standard economic categories.

Assume that the income distribution is built over a closed interval[4] $[a, b]$ which is partitioned at m regular segments. Let $\theta(x)$ be the box spline of degree three[5] (Mallat S., 1999) which is a density function symmetric with compact support $[-2,2]$ and with mean and variance equal to 0 and $1/3$ respectively.

A family of density functions can be obtained in the following way. For each $m \in \mathbb{Z}^+$ fixed, let us take into consideration expression

$$\theta_{mk}(x) = s\theta(s(x-a)-k)\ k = 0, \dots, m$$

where $s = m/b - a$.

[4] In the applications [a,b] will be the sample range.

[5] It is a translation of 4 convolutions of $\mathbf{1}_{[0,1]}$ with itself. It is centered at $t = 0$. Its Fourier transformation is:

$$F_{\varphi}(\omega) = \left(\frac{\sin(\omega/2)}{\omega/2}\right)^4$$

Note that $\theta_{mk}(x)$ is a density function resulting from a translation of $\theta(x)$ towards the micropole or income level $x_k = a + \frac{k}{s}$ and a dilation by the scale factor $s^{-1} = b - a/m$.

Combining $\theta_{mk}(x)$ the following family of density functions is obtained:

$$\left\{ f_m(x) = \sum_{k=0}^{m} a_{mk}\theta_{mk}(x) \right\}_{m\in\mathbb{Z}^+} \qquad (1)$$

where $a_{mk} > 0 \quad \forall k = 0,1,\dots,m;\ \sum_{k=0}^{m} a_{mk} = 1$.

The parameter *m* or $s = m/b - a$ determines the level of resolution which can change from a minimum value, that is $m = 1$ or $s = 1/b - a$, to a larger resolution in such a way that the income of each individual is located as close as desired to a micropole. In order to determine an optimum value of *m* one selects the smallest *m* that produces a density model that is not rejected by a test of goodness of fit like the Kolmogorov-Smirnov.

The coefficients of model (1) are estimated by the maximum likelihood procedure using the EM algorithm (Hartley, 1958; Dempster et al., 1977; McLachlan and Krishman, 1997) for a given value of *m*. Therefore they are consistent, asymptotic unbiased and asymptotic efficient.

The mean and the variance of the density function f_m are given by (see Palacios and Garcia, 2007 for details):

$$\mu = E_f[X] = a + \sum_{k=0}^{m} \frac{k a_{mk}}{s} \qquad (2)$$

$$V_f(X) = E_f[(X-\mu)^2] = \frac{1}{3s^2} + \sum_{k=0}^{m} a_{mk}\left(\frac{k}{s}\right)^2 - \left(\sum_{k=0}^{m} \frac{k a_{mk}}{s}\right)^2$$

2.2 Detecting sub-populations. The LTSUB algorithm

As we pointed out in the previous section, the MRA pdf's capability for local analysis allows us to identify sub-populations. Given that the emergence of multiple modes reveals the existence of different sub-populations placed around these modes, we part from obtaining the modes of the estimated MRA pdf. To select the significant modes a four step algorithm is defined (Palacios and Garcia, 2008a). By significant modes we understand those associated with homogeneous and significantly sized groups. This is because the contribution of the

modes located around very small sub-populations to generate conflict is minimal and they do not supply relevant information for evaluating polarization.

The algorithm to **l**oca**t**ed **sub**-populations (LTSUB henceforth) is applied after estimating the density function and is composed of four steps:

1. Estimate the modes of the MRA pdf denoted by $\hat{x}_j, j = 1, \dots, q_0$

2. Divide each estimated coefficient of the MRA pdf $\widehat{\boldsymbol{a}}' = (\hat{a}_0, \hat{a}_1, \dots, \hat{a}_m)$, into the sum of $q_0$vectors $\widehat{\boldsymbol{a}}_j = \left(\hat{a}_{0,j}, \hat{a}_{1,j}, \dots, \hat{a}_{m,j}\right)$ using the expression

$$\hat{a}_{jk} = \hat{a}_k \frac{\left|x_k - \hat{x}_j\right|^{-p}}{\sum_{j=1}^{q_0}\left|x_k - \hat{x}_j\right|^{-p}}$$

where $x_k = a + \frac{k}{s}$ is the micropole where $\theta_{mk}(x)$ is located.

Parameter *p* regulates the importance of the distance between the mode $\hat{x}_j$and the micropole x_k. For higher values of *p* the coefficients $\hat{a}_{jk}$decline quickly as the modes $\hat{x}_j$ move away from x_k. For smaller values of *p* the coefficients decrease slowly. A value of *p* is selected that makes the groups more homogeneous in term of symmetry, thus minimizing the quadratic distance:

$$\sum_{j=1}^{q}\left(\mu_j - \hat{x}_j\right)^2$$

where μ_j represents the expected value of the density defined by the vectors of coefficients $\widehat{\boldsymbol{a}}_j = \left(\hat{a}_{0,j}, \hat{a}_{1,j}, \dots, \hat{a}_{m,j}\right)$. This is obtained by applying expression (2) after having normalized the coefficients.

3. Apply the hypothesis test for proportions and select the *q* significantly sized groups.

In this step a threshold or critical size, β, is established such that those sub-population smaller than $\beta$are not labelled as significant groups. After determining β a hypothesis test for proportions is applied. The groups for which the null hypothesis is rejected are termed significantly sized groups.

4. Reallocate the coefficients into the *q* significant groups, repeating step 2.

2.3 Measurement Polarization

Following Esteban and Ray (1994) the polarization is focused on the extent to which population is grouped around a small number of poles. According to these authors, if there is a

high degree of homogeneity within each group and a high degree of heterogeneity across groups, society is polarized.

Several measures of income polarization have been defined attending to different approaches emphasizing the differences between inequality and polarization. Some of them focus on the clustering of the population around two poles. This is the case of the measures proposed by Wolfson (1994) and Tsui and Wang (2000). The measures defined by Esteban and Ray (1994), Esteban, Gradín and Ray (1999), Gradín (2000), and Duclos, Esteban and Ray (2004) are developed following what they called an identity-alienation framework. Esteban and Ray (1994), through an axiomatic approach, defined a measure of polarization based on the sum of antagonisms between individuals that belong to different groups. Duclos, Esteban and Ray (2004) developed the axiomatic system of polarization and provided a measure derived from the sum of antagonisms for the case in which income distributions are described by density functions. Esteban, Gradín and Ray (1999) proposed an extension of the Esteban and Ray measure which corrects the error that appears when the distribution is arranged into groups. D'Ambrosio (2001) proposed a modification of the ER index to evaluate polarization when the data are grouped attending to characteristics such as education, age, and region of residence as opposed to income. Following we summarize the measures of income polarization distinguishing between the measures focused on the formation of two poles and those concentrated on the formation of two or more poles.

Measures of polarization focused on the formation of two poles

- Measure of Wolfson (1994)

$$W = 4\frac{\mu}{m}\left[\frac{1}{2} - L\left(\frac{1}{2}\right) - \frac{GI}{2}\right]$$

where μ is the mean, *m* is the median income, $L\left(\frac{1}{2}\right)$ is the Lorenz curve at the median income and *GI* is the Gini index.

- Measure of Tsui and Wang (2000)

$$TW = \frac{\theta}{N}\sum_{i=1}^{k} n_i \left|\frac{y_i - m}{m}\right|^r$$

where *N* is population total, n_i is the number of individuals that belong to group i, k is the number of groups, y_i is the mean value in group i, m is the median income, θ is a positive constant and *r* takes values in the interval $(0,1)$.

Measures of polarization focused on the formation of two or more poles

- Measure of Esteban and Ray (1994)

$$ER = \sum_{i=1}^{n}\sum_{j=1}^{n} p_i^{1+\alpha}\, p_j |y_i - y_j|$$

where $|y_i - y_j|$ represents the alienation (distance) felt by individuals of (log) income $y_i$and y_j. The share of population is given by p_i and p_i^{α} represents the sense of group identification of each of the p_i members of group i within their own group.

- Measure of Esteban, Gradín and Ray (1999)

$$EGR(F;\alpha,\beta,\rho) = \sum_{i=1}^{n}\sum_{j=1}^{n} p_i^{1+\alpha}\, p_j |y_i - y_j| - \beta\varepsilon(F;\rho)$$

where $F$is the income cumulative density function, ρ is a non-intersecting partition of $F$and

$$\varepsilon(F,\rho) = G(F) - G(\rho)$$

such that $G(.)$ is the Gini index.

Duclos, Esteban and Ray (2004) translated the measure of Esteban and Ray to the continuous case using a density function. It has the expression

$$P_\alpha(f) = \iint f(x)^{1+\alpha} f(y)|y-x|dydx \qquad \alpha \in [0.25,1]$$

The measure of polarization used in this paper is consistent with the notion of polarization provided by Esteban and Ray (1994) although introduces modifications to calculate identification and alienation (this measure is defined in detail in Palacios and Garcia, 2008b).

Esteban and Ray (1994) pointed out the following features that the polarization of a distribution of individual attributes must present:

1. There must be a high degree of homogeneity within each group.
2. There must be a high degree of heterogeneity across groups.
3. There must be a small number of significantly sized groups. In particular, groups of insignificant size (e.g. isolated individuals) carry little weight.

Attending to the previous characteristics the measure of polarization used in this paper is a non-decreasing function of the following factors: the alienation and the identification felt by individuals, the distribution of the size of the groups and the number of significantly sized groups.

Being consistent to the first feature, we assume that identification is related to the similarity of the income within the group. An individual feels a sense of identification with the group to which he belongs when his income is closer to the average income of the group. In keeping with the second feature we presume that alienation is linked to the distance among the mean incomes of the groups. Attending to the previous arguments we consider, on the one hand that a global measure of identification should be inversely proportional to the variance intra-group (V_W). On the other hand, a global measure of alienation felt by individuals that belong to the same group with respect to individuals belonging to the other groups should be proportional to the variance between groups (V_B). Considering both as polarization factors we can measure the contribution of global identification-alienation to polarization by means of the index

$$I_{ia} = \frac{V_B}{V} = 1 - \frac{V_W}{V}$$

According to feature 3, we presume that a group is of significant size if it is larger than a threshold denoted by β. Assuming that polarization decreases with the number of significantly sized groups, one defines an index $\mathrm{I_g}(k)$ that quantifies the contribution of the number of groups to polarization. It is given by

$$I_{\mathrm{g}}(k) = \begin{cases} 0 & k = 1 \\ \dfrac{2}{k} & k = 2,3,\dots E\left[\dfrac{1}{\beta}\right] \end{cases}$$

where $E\left[\frac{1}{\beta}\right]$ denotes the integer part of $\frac{1}{\beta}$.

To quantify the contribution of the distribution of the size of the groups to polarization we define the index

$$I_m = \frac{c(k,\beta) - d}{(1+d)c(k,\beta)} \quad \in [0,1]$$

where *d* is a measure of distance between the distribution of the size of the groups and the distribution of maximum polarization, noted by p_j and p_j^H respectively. Assuming that $p^H = \left(\frac{1}{2}, \quad \frac{1}{2}\right)$ for $k = 2$ and $p^H = \left(\frac{1-(k-2)\beta}{2}, \quad \beta, \quad \dots, \beta, \quad \frac{1-(k-2)\beta}{2}\right)$ for $k \geq 3$, measure d is given by

$$d = \sum_{j=1}^{k} \left(p_j - p_j^H\right)^2 =$$

$$= \begin{cases} 2(p_1 - 0.5)^2 & \text{for } k = 2 \\ \left(p_1 - \frac{(k-2)\beta}{2}\right)^2 + \left(p_k - \frac{(k-2)\beta}{2}\right)^2 + \sum_{j=2}^{k-1}\left(p_j - \beta\right)^2 & \text{for } 3 \le k \le \frac{1}{\beta} \end{cases}$$

Measure d is equal to zero if $p_j = p_j^H \quad \forall j$ .The maximum value reached by the distance is given by

$$c(k,\beta) = \begin{cases} (1-2\beta)^2 & \text{for } k = 2 \\ \frac{3}{2}(1-k\beta)^2 & \text{for } 3 \le k \le \frac{1}{\beta} \end{cases}$$

It is demonstrated (see Palacios and Garcia, 2008b) that the function

$$P = I_{ia} I_m I_g$$

provides a measure of polarization over the interval $[0,1]$

3. EMPIRICAL RESULTS

Israel's population is highly heterogeneous both culturally and also with respect to the standard of living of the various population groups. The economy has been subject to significant macroeconomic shocks over the observation period. This is largely due to the small size of the economy and its high degree of openness, which is rooted in a high share of imports and largely hi-tech oriented exports (including sales of start-ups), but also in the considerably liberal regime of international capital flows[6]. Macroeconomic vulnerability is further enhanced by the repeated violent outbursts of the Israeli-Arab conflict. These have exposed the Israeli economy to significant shocks. However, part of the sharp changes in income distribution have also been directly induced by a radical mix of macroeconomic and socio-economic policies over the last couple of years.

Foreign worker policy, combined effect of tax policy, deficit policy and desire to reduce the social safety net which in the past was characterized by a high degree of solidarity.

The analysis is performed on Israeli income and demographic data from the income survey. At this stage all the monetary variables are in nominal terms. This does not influence the polarization calculations since these were calculated for each year separately.

[6] See Gottlieb and Blejer (2001).

3.1 Description of the survey

The data is from the annual income surveys for the years 1997 to 2006 for Israel, collected by the Israeli Central Bureau of Statistics, CBS. The number of households surveyed each year varies between 12,834 and 14,415. The average mean net equivalized income varied between 3258 NIS and 3992 NIS per month. All monetary variables are presented in nominal terms. This does not affect the polarization indices, since these are calculated separately for each year. Additional basic statistics on the data set are presented in appendix table 1.

Table 1: Basic data

	Number of households in sample	Mean income	Income Variance	Average number of school years*	Average family size	Average number of earners in hh.
1997	12946	2588.12	22860.86	12.29	3.46	1.45
1998	13499	2772.47	25246.9	12.35	3.42	1.42
1999	13515	3050.79	31212.6	12.48	3.38	1.2
2000	13485	3240.95	42407.02	12.48	3.34	1.23
2001	13689	3379.9	36499.94	12.53	3.33	1.19
2002	14201	3385.88	38675	12.63	3.35	1.17
2003	14418	3355.48	38009.47	12.68	3.4	1.17
2004	14636	3460.89	30801.67	12.72	3.35	1.19
2005	14545	3643.4	45100.38	12.79	3.35	1.2
2006	14582	3992.27	53300.52	12.9	3.33	1.24
2007	14147	4069.49	38979.52	13	3.31	1.23

*Data excludes Arabs of East Jerusalem due to problems of data collection

3.2 Analysis and results (in progress)

To model the equivalized net income distribution the MRA pdf given by (1) is used. The coefficients of the MRA model given by expression (1) are estimated by the maximum likelihood procedure using EM algorithm (Hartley, 1958; Dempster et al., 1977; McLachlan and Krishman, 1997). Different approximations, to the theoretical distribution, are performed by increasing de resolution level *m*. Attending to the parsimony principle, the model with minimum *m* which is non-rejected by the test of Kolmogorov-Smirnov fits well to the pdf and will be used to apply the measure of polarization.

After estimating the MRA pdf the numbers of groups and their location is obtained applying the LTSUB described in Section 2 (for details see Palacios-Gonzalez and García-Fernández 2008a). To apply the LTSUB algorithm we assume that a group is significant if its size is greater than 3%. In the year 1997 the algorithm detected four groups (see Table 2). There were three

significant groups in each year from 1998 to 2007 whose estimated sizes, modes and means appear in Table 3.

Figures 1-11 display (see appendix 1) the estimated MRA pdf of the overall population as well as the MRA pdf of each group from 1997 to 2007.

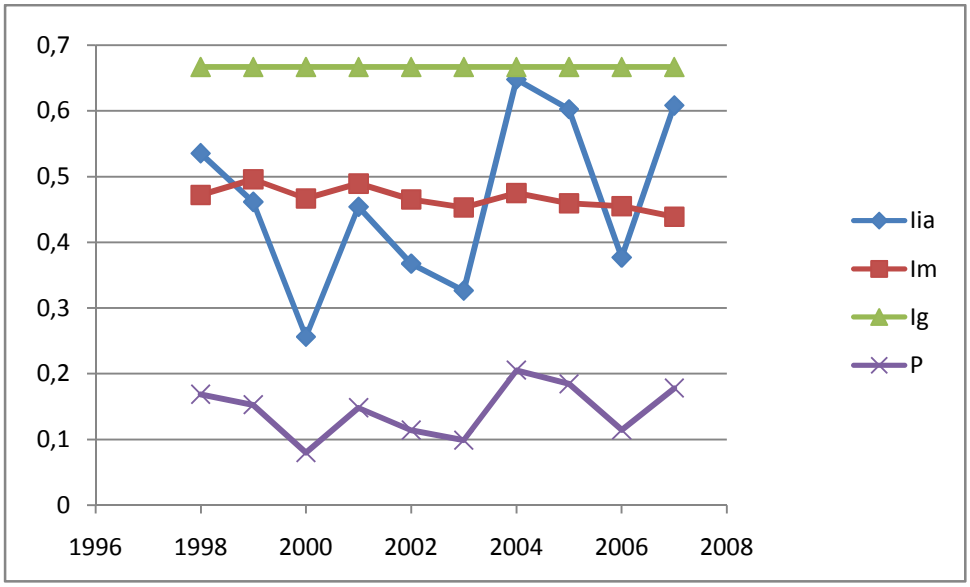
Also, in this paper income polarization is analyzed attending to demographic variables or characteristics such as religion, age of the head of household, level of education of the head of household and number of children of the household. To study income polarization according to the previous variables we proceed in the following way. Having estimated the size of each group we calculate the kth quantiles, denoted by $Q_1, \dots, Q_k$, associated with the k significant groups using the MRA cumulative pdf. Considering that $[a, b]$ is the quasi support of the income distribution we build the non-intersecting partition

$$(a, Q_1, \dots, Q_k, b)$$

that allows us to classify the household by the demographic characteristic. After that, measure (2) is applied modifying the critical size of the group β. In particular, $\beta$is the size of the smallest group in each demographic variable .

Although it is well known that polarization does not necessarily coincide with changes in poverty during the observation period polarization fluctuated with a downward trend (see Chart 1), despite ample evidence of a sharply deteriorating poverty situation during the same period. Then, polarization has been rising again during the growth episode. Over the whole period polarization has been declining. The diminishing of polarization is explained by the increasing of the size of the middle class (see Table 4).

Chart 1. Polarization and Components



The three components of polarization evolved quite differently over time.

The number of income classes dropped from four to three classes, remaining stable since then (I_g). This implies an increase in polarization or a reduction in social stability.

Another important influence on social stability is derived from the effects of identification of group members within their income group and the alienation between them as reflected in the development of average incomes and variances. This effect improved social stability until 2003 by about one third, worsening it thereafter sharply. This development coincides with the anti-social policy package that consisted of a deep and concurrent cut in child allowances, a cut and a tightening of criteria for receiving income support in working age. Furthermore the rule of adjustment of benefits was changed to the disadvantage of benefit receivers – away from the average wage to an indexation to the cost of living.

Note that although the polarization fluctuates around a trend that can be considered horizontal, the I_m component has a negative trend due to the tested increase of the size of the middle class (the hypothesis of slope equal to zero in the fitted linear trend is rejected). The distributions of the size of the groups explain the downward trend of polarization (the significance test rejects the hypothesis of slope zero in the fitted linear trend). This factor of polarization reflects how changes in the size of the middle class affect polarization. Chart 2 shows the decreasing trend of this factor and Chart 3 shows the relationship between I_m and the sizes of the middle class.

Chart 2. Trend of the factor I_m

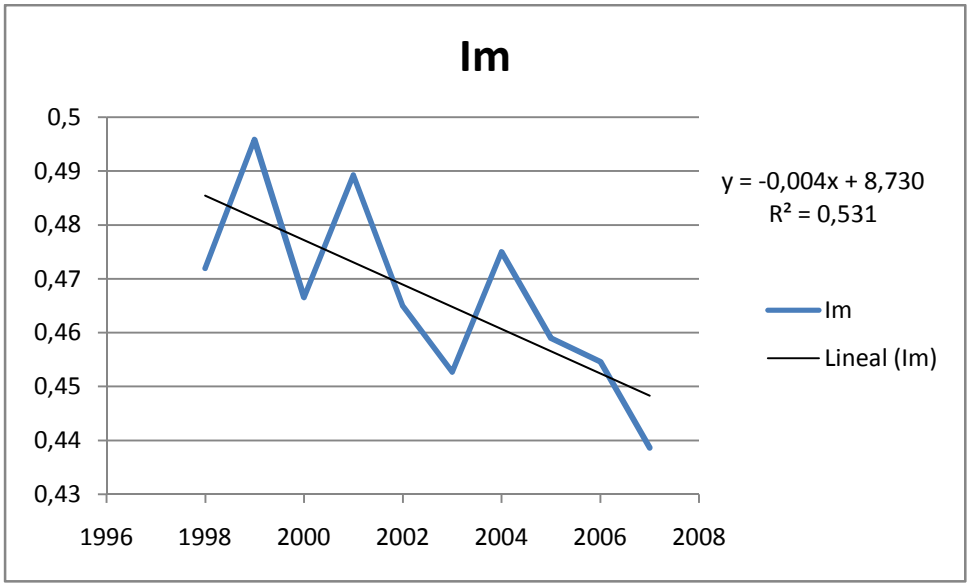
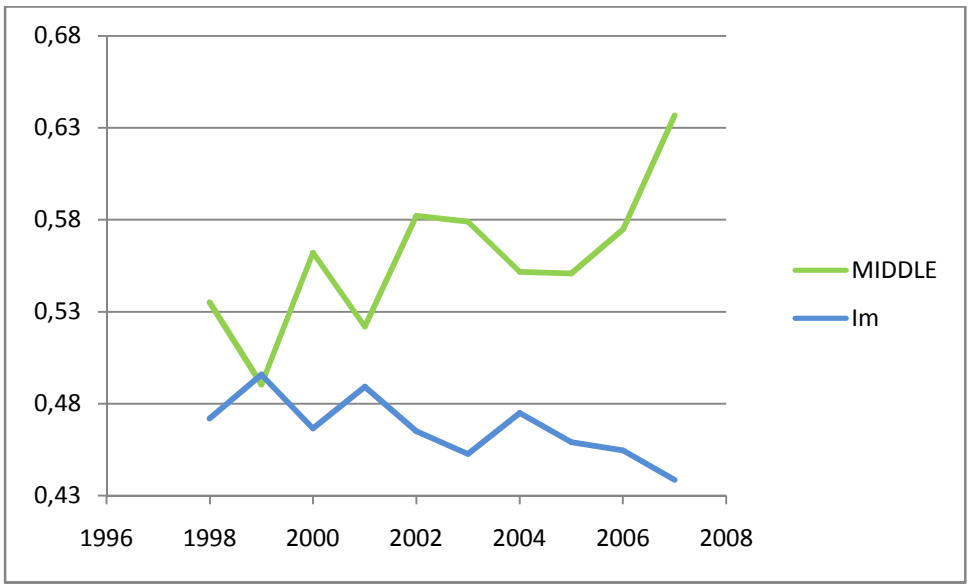


Chart 3.Factor I_m and sizes of the middle class



Observe the sensibility of factor I_m , and hence of the measure of polarization proposed, with respect to changes in the size of the middle class. An increase of the middle class implies a diminishing of I_m and hence of the measure of polarization all the rest remain unchanged. In our case this does not occur mainly due to the behavior of the factorI_{ia}.

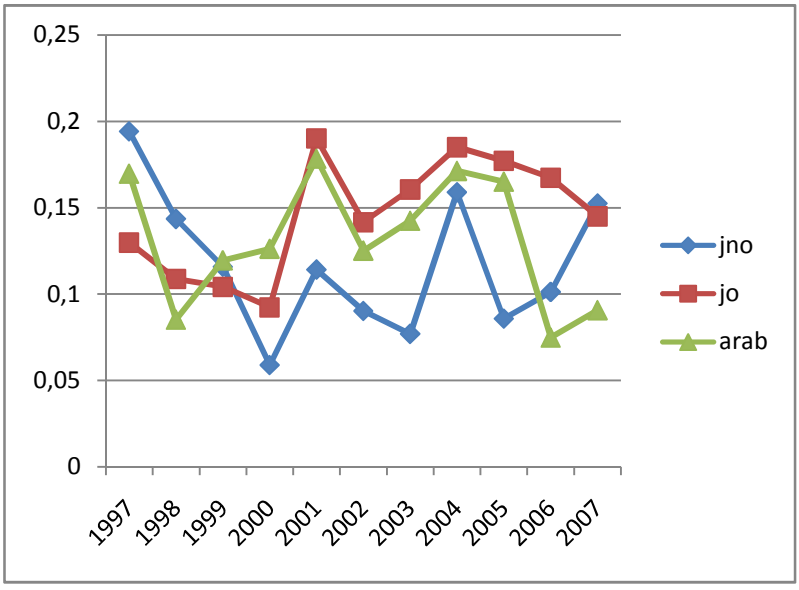
Due to considerable demographic, cultural and socio-economic differences the economic analysis usually distinguishes between the Jewish and Arab populations. This seems to be justified also in the present context. Within the Jewish population there is also strong heterogeneity between the ultra-religious Jews and the rest. The major differences are concentrated in both cultural-religious and demographic aspects. Arabs and ultra-religious

Jews have in common the large family size (see Appendix table 1), whereas the labor market behavior is quite different. In the Arab society, especially in the South of Israel, the labor force participation rate of women is very low, whereas in the ultra- religious Jewish group the woman is often the major bread winner, while the husband is expected to excel in religious studies deep into the prime age.[7]

Chart 4 shows much similarity in the polarization experience of Arabs and the Ultra-orthodox Jews that might be explained to some extent by the policy concerning child allowances. Their cut in 2003 was nearly 50 percent concerning families with a 5th child or more. This policy matured fully only by 2004, such that the high point of this policy event may well have market the deterioration in polarization. Interestingly much of the reduction in polarization occurred thereafter in the same two groups. This development is quite opposite to what is known from the poverty analysis. This issue needs to be studied carefully in future work (in progress)

In contrast to this the polarization pattern of the non-orthodox Jewish part of the population, which amounts to about 70 percent of the whole Israeli population has been on a fluctuating but rising trend of polarization since 2000. Interestingly this tendency continued during the extended growth period from about mid 2003 till 2007.

Chart 4. Polarization by populations groups

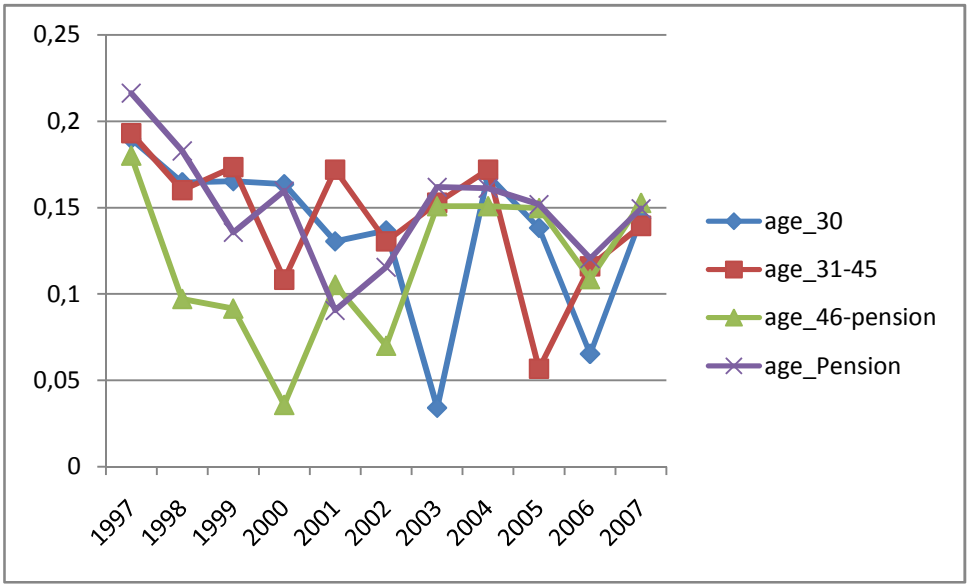


The changes in polarization by age groups seem to undergo particularly sharp fluctuations: The polarization of the old was reduced relatively steadily until 2001 and then deteriorated for the

[7] For the ultra-orthodox society see Gottlieb (2006, in Hebrew) and for a discussion of the Arab sector see Abu Bader and Gottlieb (2009).

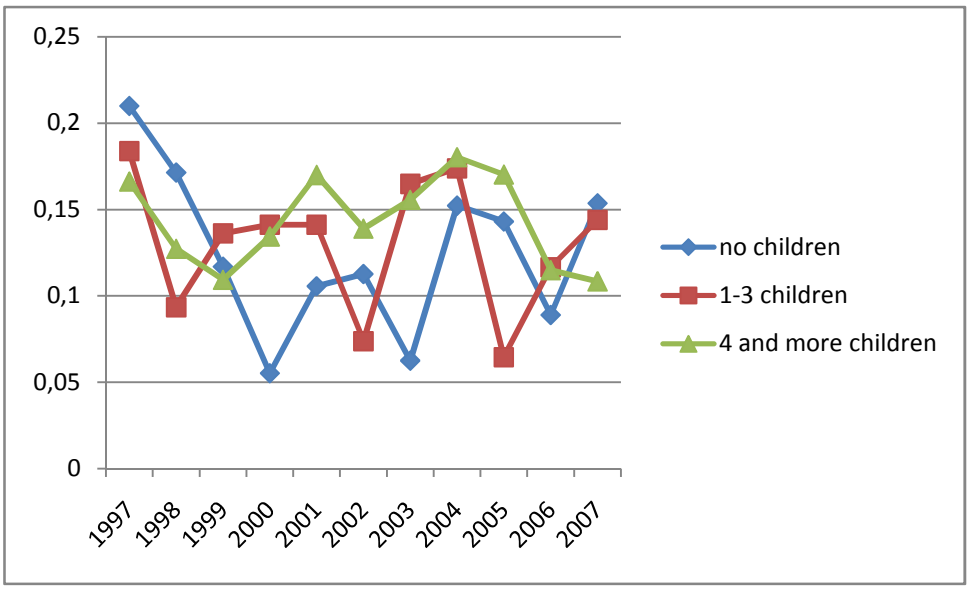
rest of the observation period. A somewhat similar pattern at an overall lower level is observed for the age group of 46 to the (moving) pension age. The pattern of the two younger age groups fluctuated more widely, a phenomenon which needs to be further researched (in progress).

Chart 5. Polarization by age groups



The results concerning family size (number of children) fits expectations reasonably well. The sharp cuts in child allowances coincide rather well with the large families' deterioration during 2002 to 2004, whereas the fall in polarization of the large family group is probably less intuitive and requires further scrutiny. On the whole children-less families fared somewhat better.

Chart 6. Polarization by family size



4.CONCLUSIONS (in progress)

Polarization shows a distinctly different pattern of social development from the poverty analysis as reflected in the commonly accepted squared FGT measure.[8] Poverty severity worsens sharply in 2003 and even more so in 2004 and then continues to worsen, though at a low pace, at a high level. Viewed apart from the polarization analysis one would intuitively suggest that social stability is expected to be severely disturbed in such an economy. However, the polarization analysis reveals that the values of the suggested measure fluctuate around a horizontal trend. Additionally, we observe a rather fluctuating and blurred picture when considering it in a more disaggregated analysis.

5.REFERENCES

Alesina Alberto and Edward L. Glaeser, 2004, "Fighting Poverty in the US and Europe, A World of Difference, Oxford University Press.

Burtless Gary, 2007, “Globalization and Income Polarization in Rich Countries”, Issues in Economic Policy, Brookings Institution, April, 1-36.

D’Ambrosio C. 2001, “Household characteristics and the distribution of income in Italy: an application of social distance measures”, Review of Income and Wealth, 47(1), pp. 43-63.

Duro Juan Antonio, 2005, “Another look to income polarization across countries”, Journal of Policy Modeling 27, 1001–1007.

Dempster, A., Laird, N., and Rubin, D. ,1977, “Maximum likelihood for incomplete data via the EM algorithm”, Journal of the Royal Statistical Society, Series B, 39(1):1-38.

Duclos, J. Y., Esteban J.M., and Ray D. ,2004, “Polarization: Concepts, Measurement, Estimation” , Econometrica, 74 pp1337-1772.

Esteban J.M., and Ray D. ,1994, “On the Measurement of Polarization”, Econometrica, 62 (4), pp. 819-851.

Esteban J.M., Gradín C. and Ray D., 1999, Extensions of a Measure of Polarization OCDE Countries, Luxembourg income Study, Working Paper, 218, New York.

Gottlieb Daniel, 2007, "Poverty and Labor Market Behavior in the Ultra-Orthodox Population in Israel" (Hebrew), July, 1-56, www.vanleer.org.il/econsoc/pdf/1_research_mdiniut4.pdf

[8] The official measure is defined by a poverty definition of the half median equivalized income with quite a similar equivalence scale to the OECD scale used for many years. Here the squared FGT measure is normalized to 100 in year 2002.

Gottlieb Daniel and Suleiman Abu Bader, 2007, "Poverty in the Bedouin Society", (preliminary abstract) Forthcoming at Van Leer Institute, Jerusalem, Israel, http://www.vanleer.org.il/econsoc/4_igeret3/6_abubader_gotlib.pdf

Gottlieb Daniel and Leonid Kushnir, 2006, "An Optimal Method of Binary Information Transfer (BIT) Between Surveys of an Identical Population: Poverty among the Jewish Ultra-Orthodox in Israel – A Case Study of BIT", August, http://ideas.repec.org/e/pgo33.html.

Gottlieb Daniel and Mario Blejer, 2001, "Liberalization in the Capital Account of the Balance of Payments," in "From Government Intervention to a Market Economy: The Israeli Economy 1985-1998", in Memory of Michael Bruno" ed: Avi Ben-Bassat, English, MIT Press, 291 - 340. http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=9095

Gradín C., 2000, "Polarization by sub-populations in Spain, 1973-91" , Review of Income and Wealth, 46 (4), pp. 457-474.

Hartley, H.,1958, "Maximun likelihood estimation form incomplete data", Biometrics, 14, pp.174-194.

Mallat, S.,1999, A Wavelet Tour of Signal Processing. Academic Press Cambridge.

McLachlan, G. and Krishnan, T.,1997, The EM algorithms and extensions. Wiley series in probability and statistics. Jonh Wiley &Sons.

National Insurance Institute, 2008, Poverty and Social Gaps, Annual Report, November, Jerusalem, Israel, 1-54.

National Insurance Institute, 2008, Poverty and Social Gaps, Annual Report, November, Jerusalem, Israel, 1-54.

Palacios-González, F, and García-Fernández R., 2007, A multiresolution analysis on income polarization. Paper presented in MASHS 2007 Conference (Forthcoming at EJESS).

Palacios-González, F, and García-Fernández R., 2008a, A MRA-based pdf model to detect sub-populations. An income polarization appliance (in press).

Palacios-González, F, and García-Fernández R.,2008b, Polarization in a mixture of density functions. Paper presented in the Research Workshop of the Israel Science Foundation on Income Polarization: Measurement, Determinant, Implications.

Tsui, K and Wang, Y. ,2000, Ordering and New Classes of Polarisation Indices, Journal of Public Economic Theory, 2 (3), pp. 349-363

Wolfson, M. C. 1994, When Inequalities Diverge?, American Economic Review, 84, pp.353-58.

APPENDIX

Figure 1. Global pdf and group pdfs for 1997

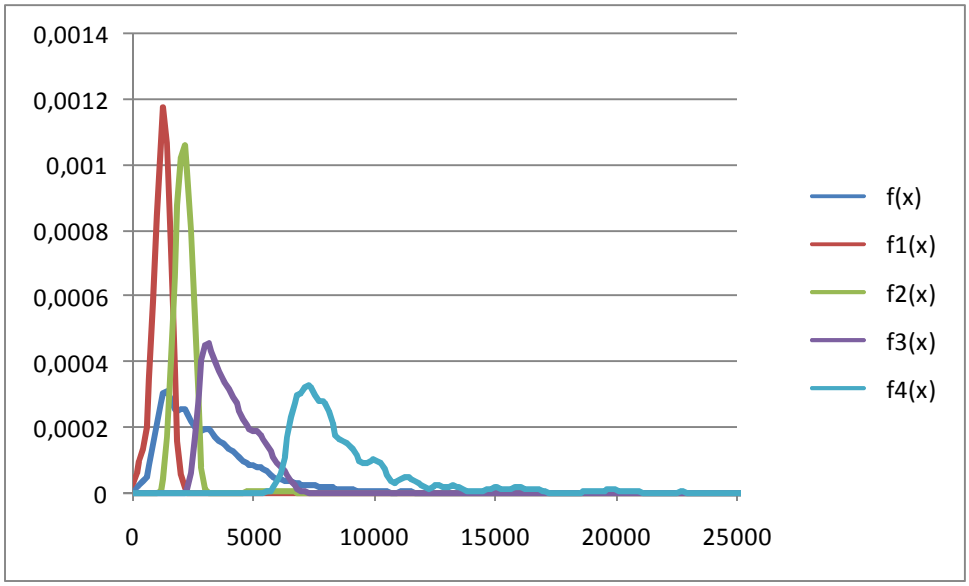


Figure 2. Global pdf and group pdfs for 1998

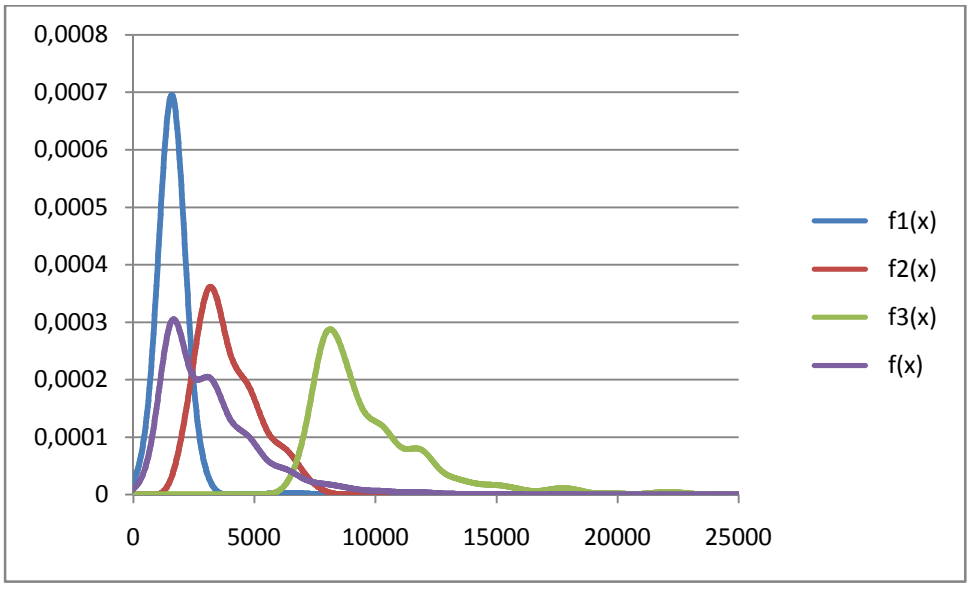


Figure 3. Global pdf and group pdfs for 1999

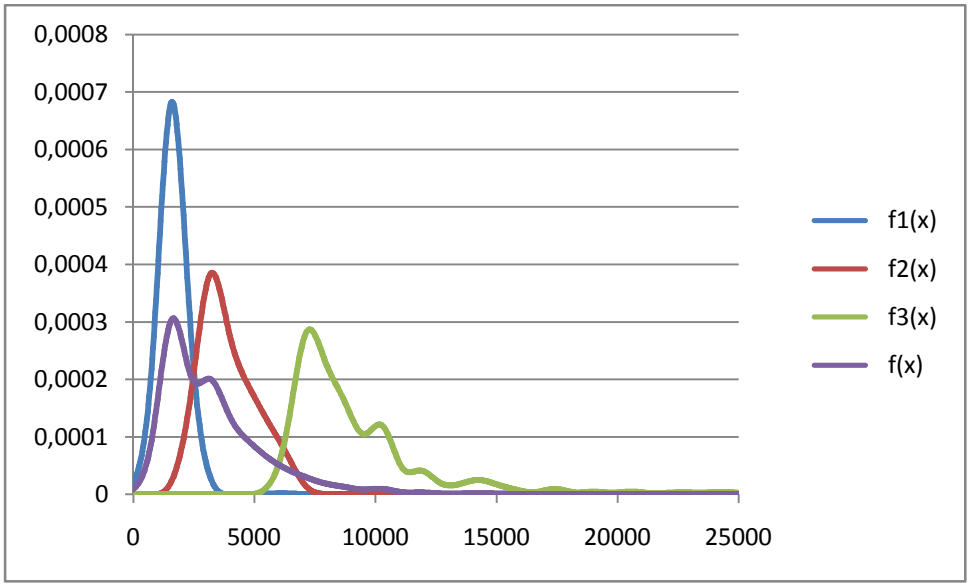


Figure 3. Global pdf and group pdfs for 2000

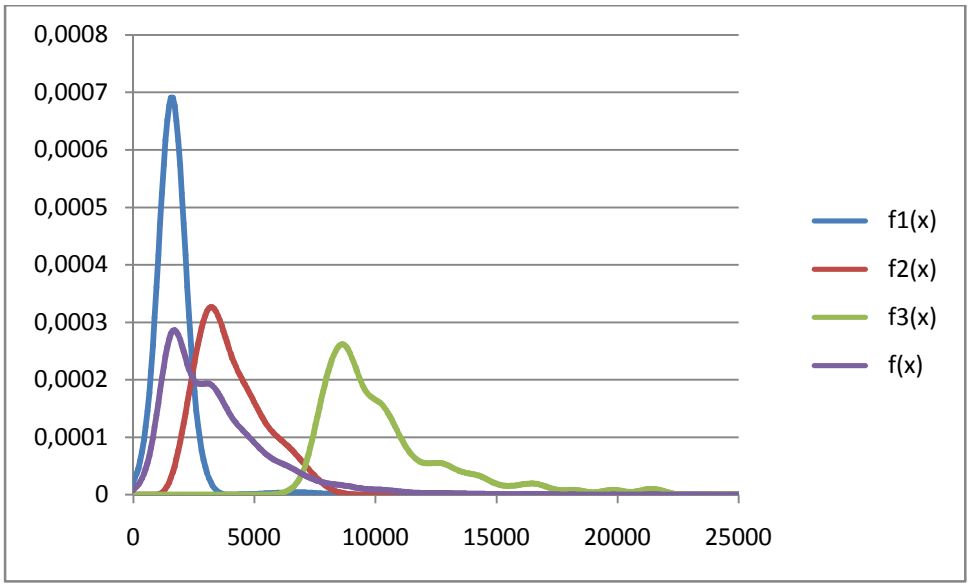


Figure 5. Global pdf and group pdfs for 2001

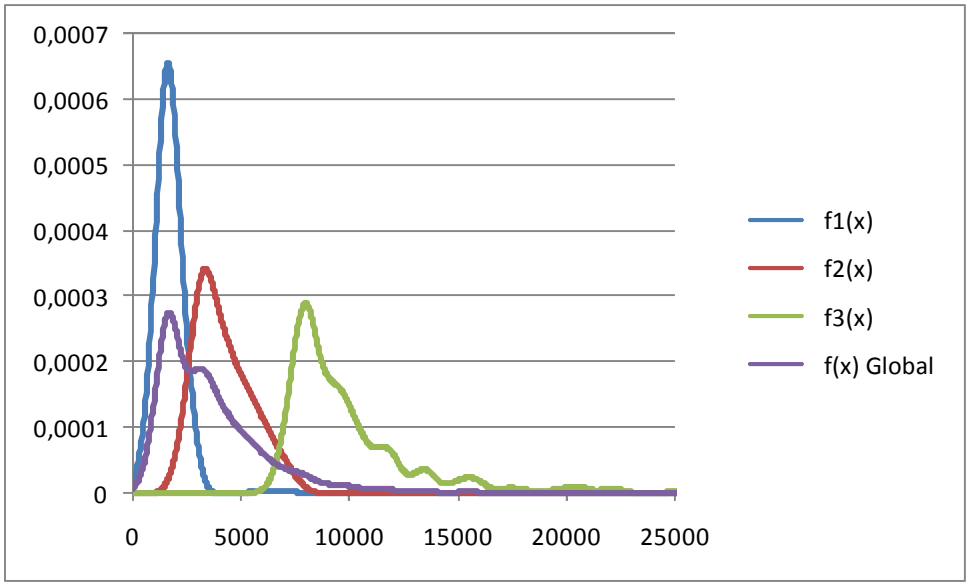


Figure 6. Global pdf and group pdfs for 2002

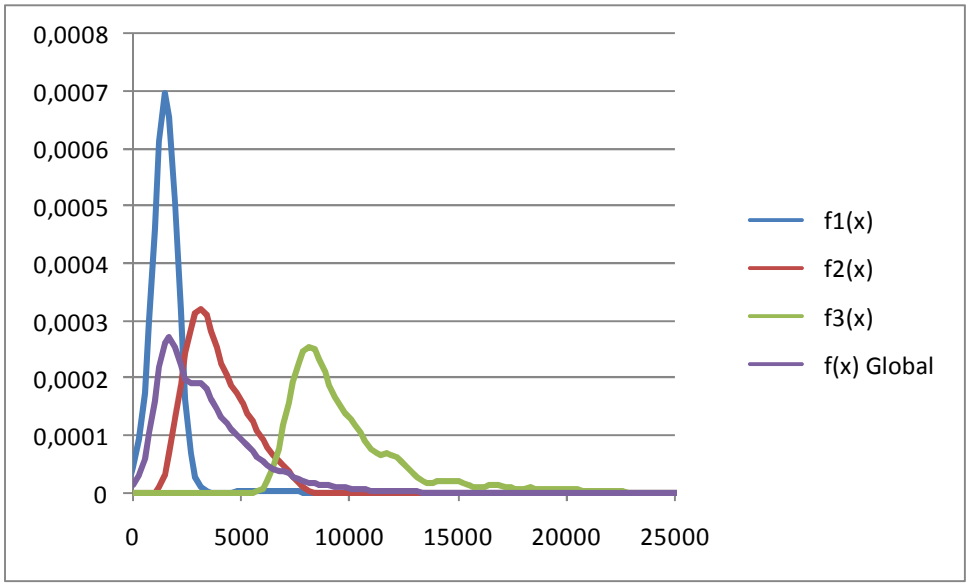


Figure 7. Global pdf and group pdfs for 2003

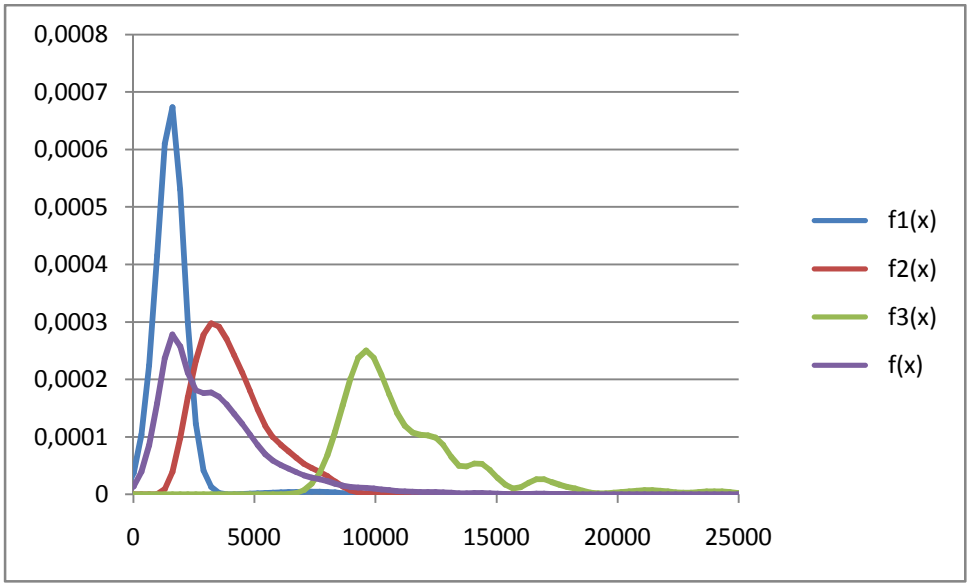


Figure 8. Global pdf and group pdfs for 2004

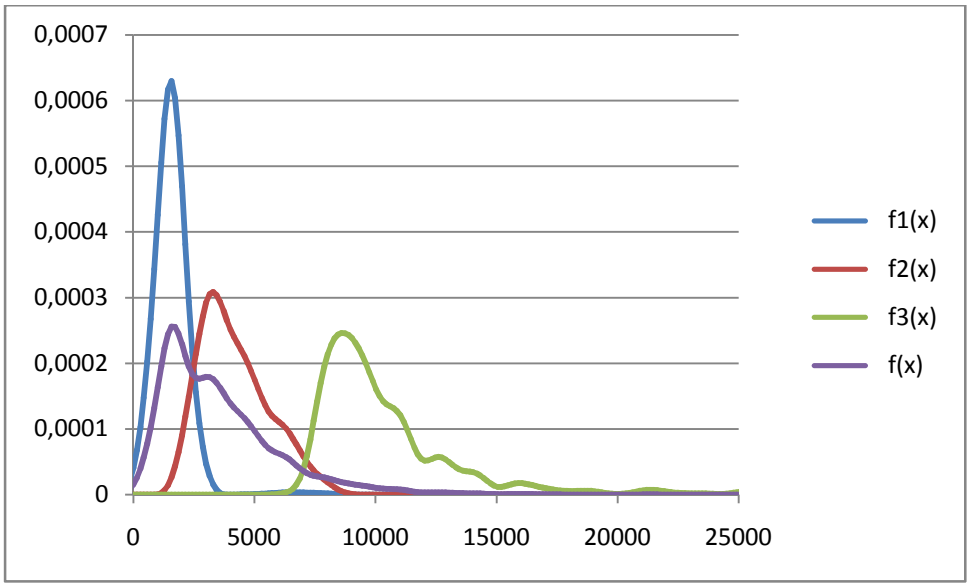


Figure 9. Global pdf and group pdfs for 2005

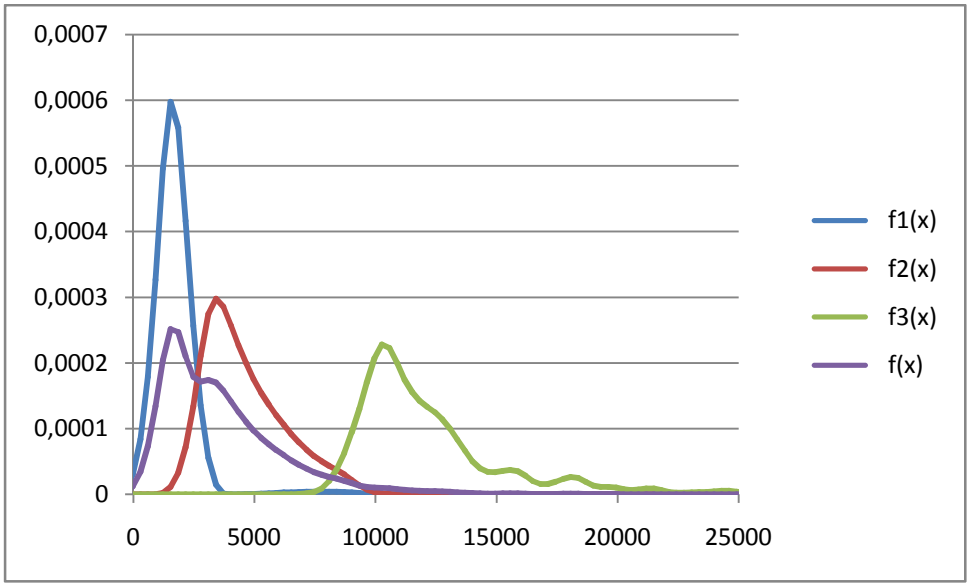


Figure 10. Global pdf and group pdfs for 2006

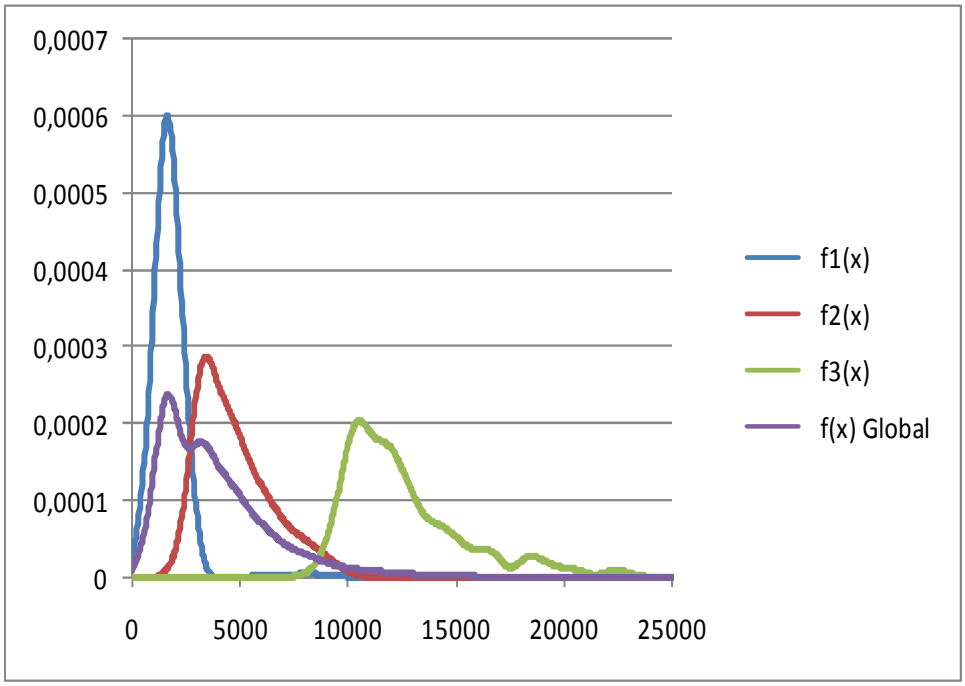


Figure 11. Global pdf and group pdfs for 2007

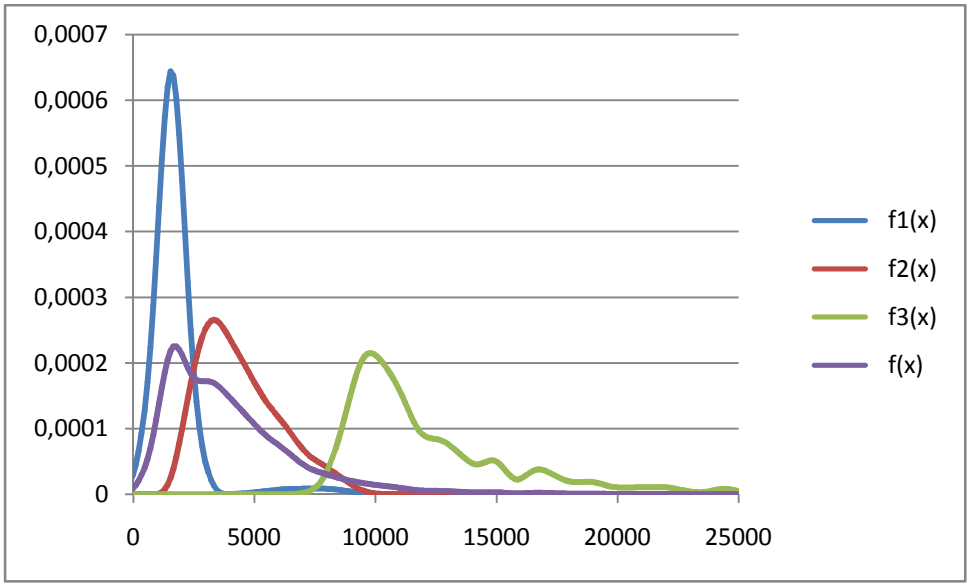

0,0007
0,0006
0,0005
0,0004
0,0003
0,0002
0,0001
0
0
5000
10000
15000
20000
25000
f1(x)
f2(x)
f3(x)
f(x)

Table 1. Basic data

		1997	1998	1999	2000	2001	2002
Total population	Number of households in sample	12946	13499	13515	13485	13689	14201
	Mean income	2588.12	2772.47	3050.79	3240.95	3379.9	3385.88
	Income Variance	22860.86	25246.9	31212.6	42407.02	36499.94	38675
	Average number of school years*	12.29	12.35	12.48	12.48	12.53	12.63
	Average family size	3.46	3.42	3.38	3.34	3.33	3.35
	Average number of earners in hh.	1.45	1.42	1.2	1.23	1.19	1.17
Non-Ultra-orthodox Jewish families	Number of households in sample	11028	11248	11125	11298	11357	11762
	Mean income	2757.16	2960.37	3267.64	3469.1	3624.88	3633.87
	Income Variance	23053.63	26390.32	31945.29	45294.8	38505.35	40907.91
	Average number of school years*	12.61	12.64	12.76	12.71	12.8	13
	Average family size	3.18	3.16	3.13	3.1	3.09	3.08
	Average number of earners in hh.	1.47	1.45	1.23	1.25	1.22	1.2
Ultra-orthodox Jewish families**	Number of households in sample	289	439	438	466	472	479
	Mean income	2341.76	2286.28	2726.12	2530.27	2468.2	3230.09
	Income Variance	31719.65	19210.04	31797.54	22352.95	22480.25	29971.83
	Average number of school years*	14.84	14.31	14.19	14.18	13.44	12.88
	Average family size	4.21	4.17	3.9	4.37	4.22	3.29
	Average number of earners in hh.	1.33	1.33	1	1.13	0.93	1.1
Arab families	Number of households in sample	1528	1674	1791	1720	1867	1838
	Mean income	1479.37	1589.51	1621.78	1727.56	1988.13	1790.05
	Income Variance	14242.26	11081.88	10000.15	11889.53	17496.47	13830.87
	Average number of school years*	9.63	9.85	10.2	10.32	10.54	10.07
	Average family size	5.18	5.04	4.98	4.84	4.69	5.15
	Average number of earners in hh.	1.26	1.27	1.1	1.09	1.08	1.01
Head of household younger	Number of households in sample	2443	2403	2412	2366	2457	2618

than 30	Mean income	2328.13	2398.1	2624.62	2851.25	3052.59	2847.57
	Income Variance	18461.47	18151.39	20488.53	22730.35	32357.39	23174.62
	Average number of school years*	12.93	12.83	13	13.09	13.19	13.21
	Average family size	3.37	3.27	3.25	3.24	3.23	3.35
	Average number of earners in hh.	1.51	1.49	1.36	1.39	1.34	1.32
Head of household between age 31 and 46	Number of households in sample	4442	4581	4535	4503	4502	4643
	Mean income	2467.27	2610.92	2826.75	3105.58	3148.95	3192.68
	Income Variance	19077.09	18897.87	21830.23	32845.96	26369.28	30696.71
	Average number of school years*	13.02	13.16	13.27	13.27	13.27	13.25
	Average family size	4.41	4.41	4.36	4.28	4.28	4.29
	Average number of earners in hh.	1.5	1.48	1.39	1.43	1.41	1.37
Head of household between age 46 and pension age***	Number of households in sample	3296	3603	3646	3805	3862	3995
	Mean income	3129.53	3348.85	3767.45	3872.68	3996.95	4060.57
	Income Variance	26975.2	34621.38	43243.17	63689.3	37765.12	38702.24
	Average number of school years*	12.69	13.03	13.09	12.97	13.04	13.14
	Average family size	3.69	3.64	3.62	3.54	3.49	3.47
	Average number of earners in hh.	1.79	1.75	1.65	1.63	1.56	1.55
Head of household at pension age***	Number of households in sample	2765	2912	2922	2811	2868	2945
	Mean income	2384.96	2651.27	2881.67	2978.28	3215.46	3262.57
	Income Variance	25225.48	23828.02	31225.92	29632.38	48558.78	55640.38
	Average number of school years*	9.98	9.8	10.06	10.02	10.08	10.43
	Average family size	1.7	1.69	1.66	1.68	1.66	1.7
	Average number of earners in hh.	0.43	0.41	0.22	0.22	0.2	0.21
Head of household with 8 years of schooling or less	Number of households in sample	2294	2354	2227	2185	2177	2155
	Mean income	1628.68	1746.34	1921.46	2110.93	2116.17	2180.91
	Income Variance	12735.63	11824.64	13825.12	19690.98	15211.76	19332.76
	Average number of school years*	5.54	5.5	5.58	5.51	5.5	5.56

	Average family size	3.28	3.09	3.03	2.94	2.89	3.1
	Average number of earners in hh.	1.05	0.94	0.64	0.62	0.53	0.54
Head of household with 9 to 12 years of schooling	Number of households in sample	5317	5461	5513	5283	5385	5606
	Mean income	2363.19	2520.06	2652.46	2917.74	2930.57	2931.54
	Income Variance	18350.98	23367.52	20537.64	54787.87	24973.7	26427.11
	Average number of school years*	11.27	11.27	11.26	11.32	11.31	11.31
	Average family size	3.7	3.67	3.63	3.61	3.57	3.58
	Average number of earners in hh.	1.48	1.48	1.27	1.31	1.26	1.22
Head of household with 13+ years of schooling	Number of households in sample	5335	5684	5775	6017	6127	6440
	Mean income	3236.18	3438.67	3836.39	3937.27	4196.08	4181.34
	Income Variance	27488.3	28575.12	40567.3	33513.16	46504.91	48953.36
	Average number of school years*	16.24	16.21	16.14	16	15.96	16.12
	Average family size	3.28	3.32	3.28	3.24	3.26	3.23
	Average number of earners in hh.	1.54	1.51	1.35	1.37	1.35	1.34
Household without children	Number of households in sample	6500	6833	6879	6905	7125	7467
	Mean income	2838.22	3007.43	3375.85	3607.3	3751.34	3763.04
	Income Variance	26102.89	24691.6	36080.1	55065.78	42473.27	46165.71
	Average number of school years*	11.81	11.75	12.03	12.01	12.11	12.29
	Average family size	2.05	2.08	2.03	2.06	2.04	2.05
	Average number of earners in hh.	1.22	1.22	0.9	0.94	0.91	0.91
Household with 1 to 3 children	Number of households in sample	5442	5584	5525	5529	5492	5603
	Mean income	2511.76	2714.46	2895.73	3034.11	3178.43	3211.44
	Income Variance	18716.03	27021.31	25088.01	22231.7	29115.8	28659.87
	Average number of school years*	12.92	13.09	13.12	13.13	13.17	13.24
	Average family size	4.33	4.3	4.29	4.26	4.25	4.25
	Average number of earners in hh.	1.68	1.65	1.6	1.61	1.58	1.55
Household with 4 or	Number of households in	1004	1082	1111	1051	1072	1131

more children	sample						
	Mean income	1481.85	1593.17	1789.27	1842.05	1892.69	1758.28
	Income Variance	14702.27	10902.47	19100.98	12885.54	15815.61	12351.19
	Average number of school years*	11.89	12.35	12.2	12.23	12.11	11.79
	Average family size	7.39	7.35	7.33	7.27	7.27	7.48
	Average number of earners in hh.	1.31	1.23	1.12	1.14	1.06	1.01

Table 1 (continued)

		2003	2004	2005	2006	2007
Total population	Number of households in sample	14418	14636	14545	14582	14147
	Mean income	3355.48	3460.89	3643.4	3992.27	4069.49
	Income Variance	38009.47	30801.67	45100.38	53300.52	38979.52
	Average number of school years*	12.68	12.72	12.79	12.9	13
	Average family size	3.4	3.35	3.35	3.33	3.31
	Average number of earners in hh.	1.17	1.19	1.2	1.24	1.23
Non-Ultra-orthodox Jewish families	Number of households in sample	11805	12086	11854	11835	11463
	Mean income	3565.73	3702.36	3926.78	4317.01	4382.29
	Income Variance	29270.12	31455.92	48066.26	56884.52	39703.46
	Average number of school years*	13.04	13.11	13.17	13.29	13.42
	Average family size	3.16	3.13	3.09	3.09	3.07
	Average number of earners in hh.	1.2	1.21	1.23	1.27	1.26
Ultra-orthodox Jewish families**	Number of households in sample	597	545	566	669	690
	Mean income	3662.53	3354.19	3620.35	3742.8	4092.69
	Income Variance	124177.87	33373.42	31410.25	35402.78	44906.25
	Average number of school years*	13.28	13.05	13.25	13.16	13.05
	Average family size	3.64	3.55	3.58	3.43	3.46

	Average number of earners in hh.	1.16	1.12	1.29	1.16	1.16
Arab families	Number of households in sample	1891	1858	1972	1941	1849
	Mean income	1794.95	1833.66	1843.9	1900.69	2010.31
	Income Variance	19407.01	16535.13	16335.92	21374.04	17767.96
	Average number of school years*	10.15	10	10.27	10.19	10.18
	Average family size	5	4.89	4.97	4.92	4.81
	Average number of earners in hh.	1	1	1.02	1.01	1.04
Head of household younger than 30	Number of households in sample	2598	2489	2467	2470	2257
	Mean income	2896.61	3069.64	3102.12	3331.63	3422.46
	Income Variance	25454.16	27608.11	30752.72	27645.15	30516.36
	Average number of school years*	13.07	13.23	13.28	13.27	13.32
	Average family size	3.4	3.37	3.44	3.39	3.36
	Average number of earners in hh.	1.33	1.36	1.39	1.43	1.41
Head of household between age 31 and 46	Number of households in sample	4701	4787	4767	4740	4604
	Mean income	3106.52	3193.68	3397.64	3703.36	3835.69
	Income Variance	24695.95	25482.22	28603.8	46706.57	34891.61
	Average number of school years*	13.39	13.47	13.53	13.62	13.75
	Average family size	4.36	4.28	4.29	4.24	4.27
	Average number of earners in hh.	1.36	1.38	1.42	1.42	1.45
Head of household between age 46 and pension age***	Number of households in sample	4121	4523	4429	4604	4517
	Mean income	3954.22	4112.06	4264.11	4782.63	4793.68
	Income Variance	32208.61	34597.6	40424.43	68429.59	45272.93
	Average number of school years*	13.25	13.21	13.28	13.39	13.39
	Average family size	3.56	3.42	3.4	3.39	3.33
	Average number of earners in hh.	1.55	1.51	1.53	1.57	1.54
Head of household at pension age***	Number of households in sample	2998	2837	2882	2768	2769
	Mean income	3326.86	3237.09	3564.16	3760.11	3798.47
	Income Variance	62485.04	33077.51	73921.39	50377.62	37934.5
	Average number of school years*	10.41	10.21	10.39	10.52	10.8
	Average family size	1.67	1.64	1.65	1.62	1.62

	Average number of earners in hh.	0.21	0.18	0.19	0.19	0.19
Head of household with 8 years of schooling or less	Number of households in sample	2020	2051	2023	1899	1801
	Mean income	2100.83	2137.34	2185.13	2349.39	2379.76
	Income Variance	16541.65	18747.76	18401.11	27379.07	20669.18
	Average number of school years*	5.39	5.33	5.43	5.46	5.4
	Average family size	2.93	2.91	2.87	2.89	2.83
	Average number of earners in hh.	0.51	0.54	0.49	0.52	0.46
Head of household with 9 to 12 years of schooling	Number of households in sample	5700	5688	5568	5551	5285
	Mean income	2962.1	3005.01	3081.27	3316.98	3425.69
	Income Variance	45670.5	26733.57	52106.96	39664.49	28276.97
	Average number of school years*	11.34	11.33	11.33	11.36	11.37
	Average family size	3.67	3.64	3.65	3.61	3.56
	Average number of earners in hh.	1.22	1.23	1.26	1.28	1.3
Head of household with 13+ years of schooling	Number of households in sample	6698	6897	6954	7132	7061
	Mean income	4069.14	4228.38	4516.54	4962.03	4985.66
	Income Variance	33269.5	33922.41	41948.79	64085.35	45428.73
	Average number of school years*	15.99	16.03	16.09	16.08	16.13
	Average family size	3.32	3.25	3.26	3.23	3.25
	Average number of earners in hh.	1.33	1.34	1.37	1.39	1.37
Household without children	Number of households in sample	7438	7756	7625	7837	7631
	Mean income	3787.3	3893.71	4167.25	4527.99	4576.66
	Income Variance	47767.43	34114.21	55907.22	62277.48	43161.48
	Average number of school years*	12.24	12.29	12.39	12.53	12.6
	Average family size	2.07	2.07	2.05	2.05	2.04
	Average number of earners in hh.	0.91	0.93	0.94	0.98	0.96
Household with 1 to 3 children	Number of households in sample	5762	5704	5740	5557	5366
	Mean income	3129.76	3239.38	3333.57	3660.6	3795.77
	Income Variance	22888.25	25831.33	28164.14	38840.27	32880.82
	Average number of school years*	13.27	13.34	13.37	13.51	13.6

	Average family size	4.25	4.28	4.26	4.27	4.27
	Average number of earners in hh.	1.54	1.56	1.57	1.62	1.63
Household with 4 or more children	Number of households in sample	1218	1176	1180	1188	1150
	Mean income	1786.59	1682.76	1757.04	1972.9	1969.2
	Income Variance	13698.38	16815.34	15272.36	36636.69	18481.32
	Average number of school years*	12.57	12.58	12.6	12.51	12.84
	Average family size	7.54	7.32	7.42	7.43	7.31
	Average number of earners in hh.	1.07	1.05	1.1	1.14	1.13

*Data excludes Arabs of East Jerusalem due to problems of data collection
**Estimated by use of the methodology of Gottlieb and Kushnir (2007)
***Pension age rises gradually according to the pension age reform.
All variables except 'number of households in sample' are weighted.

able 1. Basic data (continued)

Table 2 . Sizes and means of the groups for 1997

1997	POOR	MIDDLE 1	MIDDLE 2	RICH
SIZE	0.25367	0.2402024	0.430087	0.07604
MEAN	1221.898	2176.4152	4026.226	9123.258

Table 3. Sizes and means of the groups from 1998 to 2007

		MEANS			SIZES	
	POOR	MIDDLE	RICH	POOR	MIDDLE	RICH
1998	1623.419	3940.2369	10141.89	0.410952293	0.535186176	0.053861531
1999	1652.505	3925.1579	9649.302	0.428815312	0.490450432	0.080734256
2000	1643.315	4060.5104	9724.905	0.381934232	0.562151006	0.055914762
2001	1722.714	4191.6229	10442.93	0.40068843	0.52190184	0.07740972
2002	1582.863	3944.44	10466.78	0.35243732	0.58213304	0.06542964
2003	1605.623	4167.5209	11851.19	0.379705421	0.578999595	0.041294984
2004	1579.969	4194.6624	10700.7	0.383070514	0.551671153	0.065258333
2005	1728.671	4599.1143	13414.25	0.410106388	0.550830563	0.039063049
2006	1787.731	4744.9595	14374.28	0.38300413	0.57481394	0.04218193
2007	1217.263	3070.6428	8986.795	0.299331921	0.636721071	0.063947008

Table 4. Measures of polarization

	Iia	Im	Ig	P	DER(0.5)	EDR(0.75)	DER(1)
1997	0.644185	0.620237	0.5	0.199774	0.225966	0.195504	0.173828
1998	0.535494	0.471954	0.666667	0.168486	0.224369	0.193985	0.172373
1999	0.461455	0.495812	0.666667	0.15253	0.229072	0.198403	0.176694
2000	0.2562	0.466559	0.666667	0.079688	0.227541	0.196175	0.173709
2001	0.454017	0.489245	0.666667	0.148084	0.228506	0.197359	0.175243
2002	0.367468	0.464985	0.666667	0.113912	0.226704	0.194242	0.170835
2003	0.326506	0.452733	0.666667	0.098547	0.228408	0.194964	0.170902
2004	0.647824	0.474996	0.666667	0.205143	0.229362	0.194379	0.169097
2005	0.602583	0.459031	0.666667	0.184403	0.232187	0.197341	0.172105
2006	0.376854	0.454589	0.666667	0.114209	0.232494	0.197583	0.172209
2007	0.608263	0.438652	0.666667	0.177877	0.229265	0.194961	0.170162