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**EMPLOYEE STOCK OPTIONS AND INCOME INEQUALITY:
THE CASE OF FINLAND 1998-2002**

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1. Introduction

Finland has traditionally been an egalitarian country. The results of Atkinson et al. (1995,45) even suggested that Finland had the least amount of economic inequality among the OECD countries in the mid-1980s. However, income disparities increased significantly in Finland in the latter part of the 1990s. At the turn of the millennium, inequality as measured by standard methods had risen at the level last seen in the early 1970s (Statistics Finland, 2004).

The surge in income inequality coincided with strong economic growth, bulging stock markets and increasing share of property income out of total household income. Official statistics showed that the real income level rose much faster in the top income decile than in the lower parts of the income distribution. The income levels at the bottom stagnated.

Growing income inequality spurred considerable public debate, usually when newspapers published person-level information on the previous year's taxation. In the media, the increase in inequality was at least partly attributed to income from employee stock options received by top management of Finnish IT firms, such as the mobile phone supplier Nokia and its subcontractors.

The empirical evidence on stock options and income dispersion relied mostly on the name lists of Finland's richest people published in the media rather than on official household income distribution statistics. Household income statistics were based on sample surveys, and could not be used to estimate the contribution of stock options on growing inequality. General remarks were sometimes made in connection with property income contributions and the increasing income share of the highest income decile (e.g. Mäkinen, 45).

With the help of a recently constructed data source on the incomes of the whole population instead of a sample, we now try to answer the question: how much of the total inequality in Finland was attributable to income from employee stock options in 1998-2002? In addition to stock options, we also examine evidence on the contributions of realised capital gains and dividends. We are thus looking at the stock market effect on income inequality in what seems to be the bubble of all times in the Finnish stock market.

The paper is organised as follows. We first summarise the evidence on the level and trend of income inequality in Finland. We proceed by describing our data and methods. We then present empirical evidence on employee stock options as an income source and the contribution of stock options on disposable income inequality.

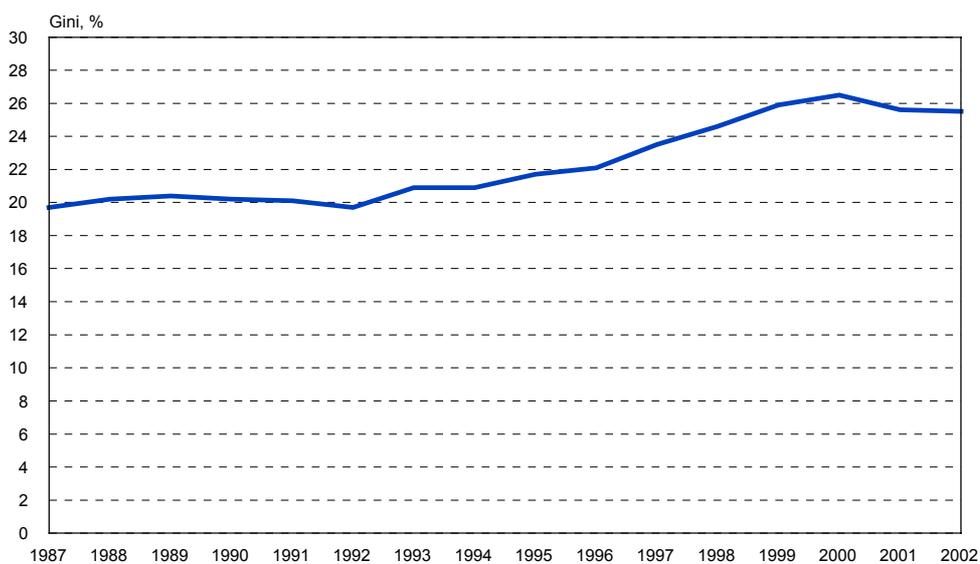
It is to be noted that stock options posed problems for other statistical systems as well. One example is the National Accounts where stock options are not included as income. Kavonius & Hamunen (2002) discuss employee stock options and holding gains and their influence on disposable income and personal saving rate. They use aggregate macro data from National Accounts and find, among other things, that employee stock options would have had a notable influence on personal saving rate in Finland after 1997.

2. Income inequality in Finland in the 1990s

Next we briefly describe the level and trend of income inequality in Finland. For a more thorough exposition, see e.g. Riihelä et al. (2002). In this section, we present the results from the sample-based Income Distribution Statistics and the European Community Household Panel (ECHP).

The available evidence on income inequality in Finland suggests a U-shaped pattern. There was a decline in inequality from the mid-1960s to the early 1980s, then considerable stability up to the early 1990s, and then a sharp rise so that at the turn of the millennium the inequality was again at the level of the early 1970s. The most recent figures from 2001 and 2002 indicate that the growth in income inequality has levelled off (Statistics Finland, 2004).

Figure 1. Income inequality in Finland 1987-2002. Gini coefficient of disposable income, modified OECD consumption units, person weights.



Source: Income Distribution Survey (IDS_SAMPLE)

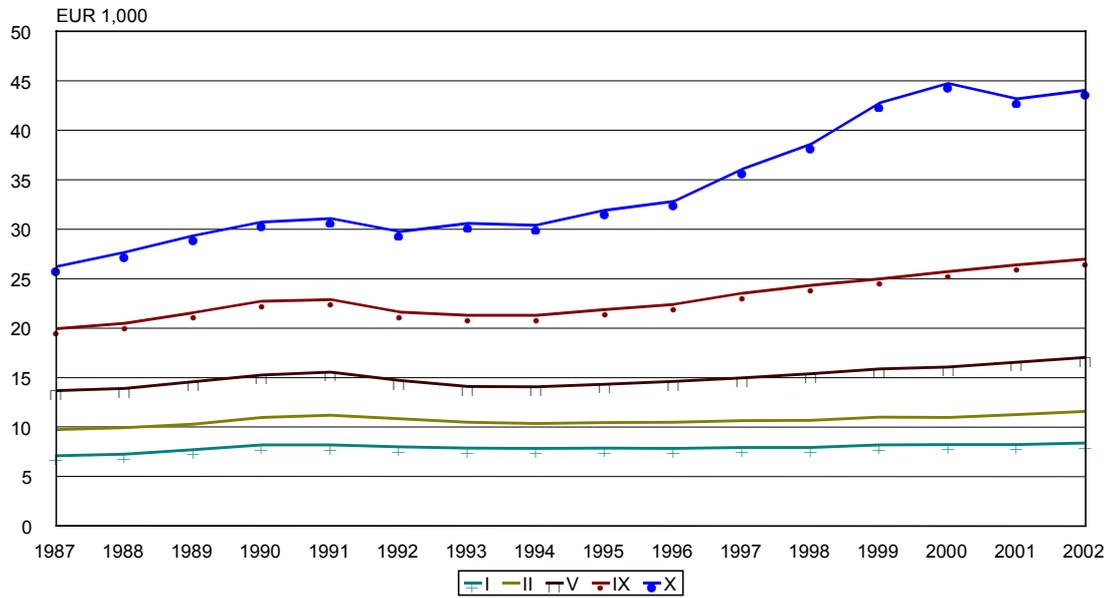
The changes in the Finnish income distribution in the late 1990s are most visible at the top. Figure 2 illustrates the development by depicting real incomes in selected decile groups for the years 1987 to 2002. During the period of continuously widening income dispersion, from 1995 to 2000, the mean real income in the highest decile grew by 40 per cent while that of the fifth decile increased by 12 per cent. The real income level of the lowest decile also grew but only by 4.5 per cent.

Much of the increase in the top decile can be attributed to the increase in income from property (see e.g. Statistics Finland, 2004; Jäntti, 2002), especially dividends and realised capital gains. The decline in the income inequality and the mean real income of the top decile in 2001 can also be attributed to property income, mostly to realised capital gains.

In spite of the recent increase in economic inequality, the latest results from the Luxembourg Income Study and the European Community Household Panel still rank Finland as a country with modest income inequality around the year 2000 (Figure 3). The other Nordic countries have experienced increasing income inequality in the 1990s as well. National income statistics of Finland, Sweden, Norway and Denmark indicate that capital income has affected income inequality in all these countries¹.

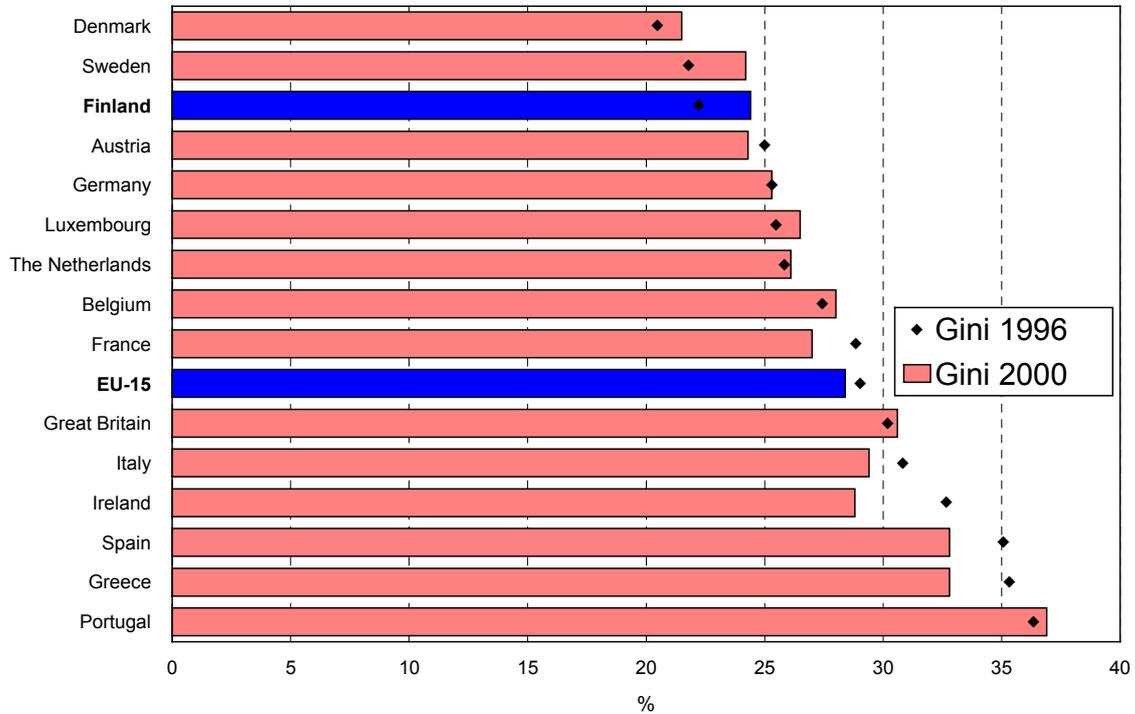
¹Statistics Sweden, Statistics Norway, Danish Ministry of Finance.

Figure 2. Estimated real mean incomes in selected decile groups in Finland 1987-2002



Source: Income Distribution Survey (IDS_SAMPLE)

Figure 3. Income inequality in the European Union (EU-15) in 1996 and 2000. Gini-coefficients. Modified OECD-scale, person weights.



Source: Author's calculations from the ECHP (UDB December 2003)

3. Data and methods

To study stock options and inequality, we primarily use the *Income Distribution Statistics for the whole population* (IDS_POP). They are constructed by combining the income registers of Statistics Finland with the population data². The data set covers the incomes of the whole resident population at the end of the year, i.e. approximately 5.2 million individuals each year. Consequently, our results are free from sampling errors or non-response bias.

Effectively, we are *using the sampling frame* instead of *sampling the sampling frame*, because sample surveys (e.g. Income Distribution Survey used in Section 2) use the population data as the sampling frame.

Income data derive from administrative and statistical registers and are considered to be of high quality. The existing sample surveys in Finland also use the same registers for the income data. The value added of the IDS for the whole population (IDS_POP) thus comes from having data for the whole population instead of a sample, not from the use of registers.

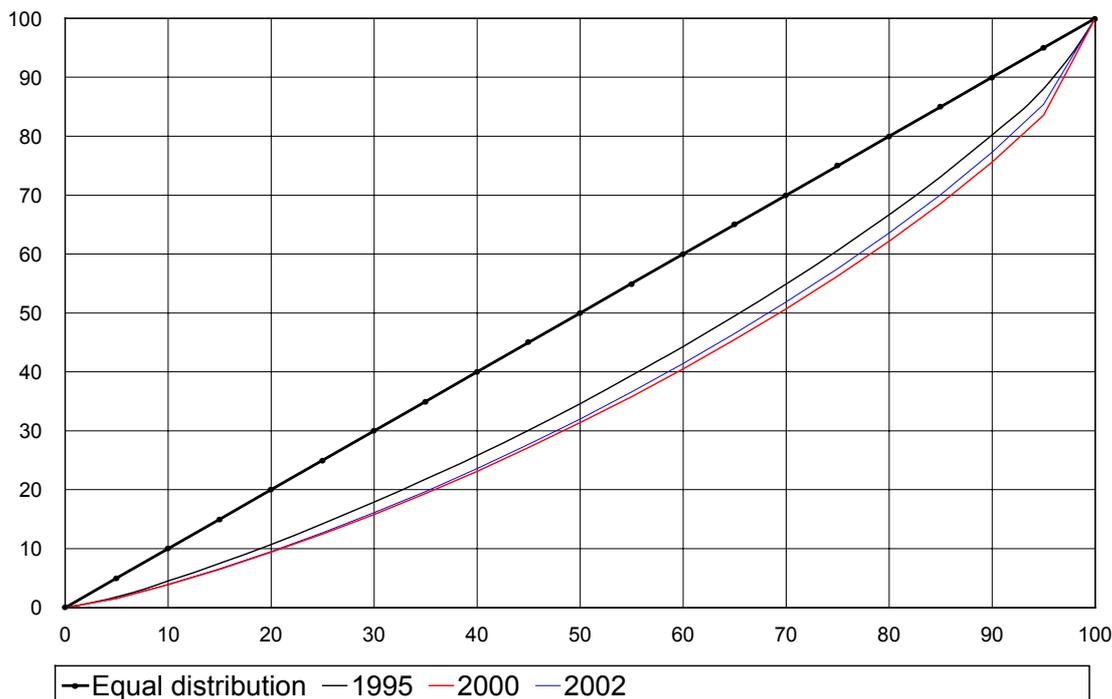
We also use the conventional sample-based source on income distribution, *the Income Distribution Survey* (IDS_SAMPLE). It consists of annual samples of around 10,000 private households. The response rates have varied between 68 to 83 per cent. In the recent years, the response rate has been about 80 per cent. The register income data are the same as in the IDS_POP. Some income components are not available from the registers and they are collected by interviewing. In this source, household is defined as an economic unit which may be different from the household dwelling-unit concept used in the IDS_POP (see Ruotsalainen (2004) on this).

To illustrate the strength of the data source that we use instead of the conventional sample survey, consider the Lorenz curves calculated from the data for the whole population (IDS_POP) in Figure 4. The 1995 curve dominates both 2000 and 2002. The 2000 and 2002 curves, instead, cross at the bottom of the income distribution, although this cannot be discerned from the figure. Figure 4 thus confirms the results from the sample-based statistics (IDS_SAMPLE): income inequality has increased since the mid-1990s.

Note that this result can be considered as very reliable. We do not have to calculate standard errors, because the depicted Lorenz curves possess no sampling error or non-response bias at all. Non-sampling errors should not be markedly different from the sample-based sources either. We thus consider the Lorenz curves calculated from the IDS_POP as the definitive evidence on income inequality in those years.

² Statistics Finland has conducted completely register-based population censuses since 1990.

Figure 4. Lorenz curves in Finland 1995, 2000 and 2002.



Source: Income Distribution Statistics for the whole population

Income concept

Income is defined as equivalent disposable money income, using modified OECD consumption units. This equivalent income is then assigned to each household member. Income is defined according to international recommendations, e.g. the Canberra group manual (2002), except for realised capital gains³. These are included as property income, as they are in all micro income statistics in Finland. For practical reasons, all interest income is missing because it is not available in the administrative registers⁴. Inter-household transfers are also missing.

Stock options data are available as a separate variable for the years 2000 to 2002 directly from the tax files. The same variable is used in all sample surveys and all register-based statistics. Moreover, the National Accounts total is based on the same variable for the years 2000 to 2002.

For the years 1998 and 1999, stock options are estimated on the basis of fringe benefits. The estimation method is straightforward: all fringe benefits exceeding EUR 12,600 are considered to be stock option income. For the years 1998 and 1999, the National Accounts totals might differ somewhat. We conclude, however, that the measurement errors should be very small and the coherence between different statistical systems (micro and macro statistics) seems to be very good.

³ More rigorously, we measure realised nominal holding gains minus losses over the holding period (Canberra Group, p. 29).

⁴ In income surveys, interest income contains a large amount of measurement error. In the IDS_SAMPLE 2002, only 40 per cent of the National Accounts' total value was captured. Using these survey data, we found that interest income would have lowered the Gini coefficient of disposable money income by less than 0.1 percentage points in 2002.

Decomposition analysis

We evaluate the share of inequality due to stock options by decomposing the Gini coefficient of disposable income by income source. We have also decomposed half the squared coefficient of variation but these results are not presented here (they are available from the author by request).

Following Lerman and Yitzhaki (1985), we decompose the overall Gini coefficient into three terms: the distribution of the income component itself, the correlation of the component with overall income, and the income share.

When we have k income sources which sum up to total income, the Gini coefficient of total income G can be expressed as:

$$(1) \quad G = \sum_{k=1}^K G_k R_k \frac{\mu_k}{\mu}$$

where G_k is the Gini of income component k , R_k is the Gini correlation, μ_k is the mean of income component k and μ is the mean of overall income.

Gini correlation is defined as

$$(3) \quad R_k = \frac{\text{cov}(y_{k,i}, F_i)}{\text{cov}(y_{k,i}, F_{k,i})}$$

where F is the cumulative distribution of the ranks of total income, F_k the same for the income component k , and y_k is the income from source k .

Gini coefficient is calculated as the covariance between incomes and their ranks:

$$(2) \quad G = 2 \frac{\text{cov}(y_i, F_i)}{\mu}$$

where y_i is the income of the i th person and F_i the cumulative distribution of income ranks.

The product of R_k and G_k is also called pseudo-Gini or the concentration coefficient. It takes values between -1 and +1. If it is -1, then the one with the lowest overall income gets all the income from component k . If it is +1, then the one with the highest overall income gets all the income from component k .

4. Employee stock options as an income source

We next present the basic facts on stock options, considering first the stock options recipients and then stock options as an income source. We also show that the sample survey data cannot be used

to study the contribution of options on income inequality because the estimate of total value that they give is often very biased.

While there were estimated 45,000 people included in stock options programmes in 2000 (Mäkinen, 46), the number of individuals who actually received income from stock options was only 3,560 in that year. This figure is extremely small. The total population of Finland is around 5.2 million individuals, clustered into 2.3 million households.

Table 1 shows the number of recipients of stock options, realised capital gains, dividends, and – to compare – of social assistance from 1998 to 2002⁵. For stock options there are two figures: the sample estimates (IDS_SAMPLE) and the known population values (IDS_POP). All other figures are based on known population values.

In terms of the number of income recipients, property income components such as realised capital gains and dividends are much more important sources of income than employee stock options. Existing sample-based income statistics seem to give surprisingly accurate estimates of the number of stock option recipients, taking into account the fact that the number of individuals in the sample ranges from 20 to 50 persons depending on the year.

Table 1. Number of individuals receiving income from stock options, realised capital gains, dividends and social assistance in 1998-2002.

	Number of income recipients, individuals				
	Sample survey estimate (IDS_SAMPLE)	Known population value			
	Stock options	Stock options	Realised capital gains	Dividends	Social assistance
1998	2,102	2,937	210,893	438,417	311,643
1999	3,895	3,817	225,597	526,310	291,579
2000	3,782	3,560	233,788	557,221	271,353
2001	4,608	4,992	168,374	627,550	263,248
2002	5,610	5,125	137,871	1,014,001	261,444

Source: Income Distribution Statistics for the whole population

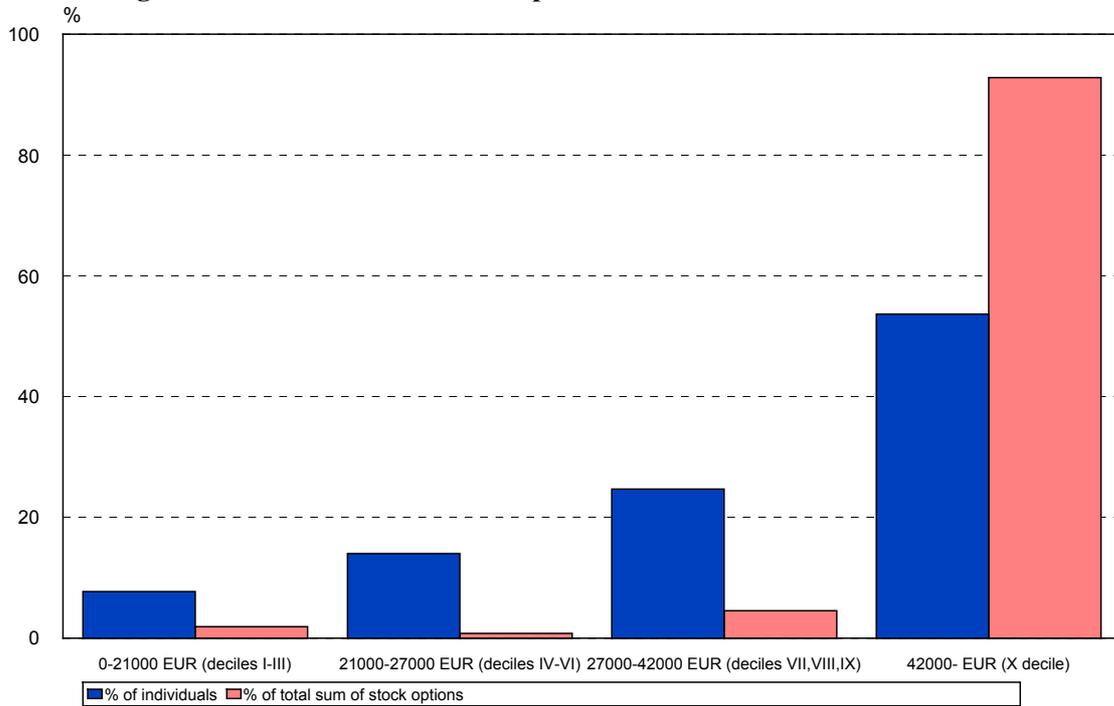
We also know that those who receive stock options income are already well off. If we remove stock options from wages and salaries, we find that more than half of the stock option recipients would still have been in the tenth wage decile in 2000⁶. Moreover, in the same year about 93 per cent of the total sum of stock options went to those individuals (Figure 5).

Using Census 2000 data on occupations, we find that the most common professions among stock option recipients in 2000 were computing professionals and electronics and telecommunications engineers. Two thirds of the recipients were male. Looking at the age distribution, 70 per cent of the income recipients were aged 30 to 49 and 40 per cent 35 to 44.

⁵ The figure for dividends doubled in 2002. The reason for this is a better registration of small dividends (mostly less than 20 euros) in the taxation. This change had little effect on the total value of stock options.

⁶ The income concept here is wages and salaries without gross stock options. Income classes are constructed on the basis of approximate decile limits of wages and salaries excluding stock options of full-time full-year employees. The source of data is the sample-based Income Distribution Survey 2000 (IDS_SAMPLE).

Figure 5. Distribution of stock option recipients and stock option income according to annual wages and salaries without stock options in 2000.



Source: Income Distribution Statistics for the whole population (IDS_POP)

In contrast to the estimates of stock option recipients, the estimates of total sums are very biased in the sample-based income statistics. Figure 6 gives the total amounts of stock options from two sources. The first bar shows the sample survey (IDS_SAMPLE) point estimate of the total sum of stock options. The line segment indicates the bootstrap estimates of 95 per cent confidence limits. The second bar shows the total value of stock options in the income distribution statistics for the whole population (IDS_POP). Obviously enough, there are no confidence limits because there is no sampling error in the estimates.

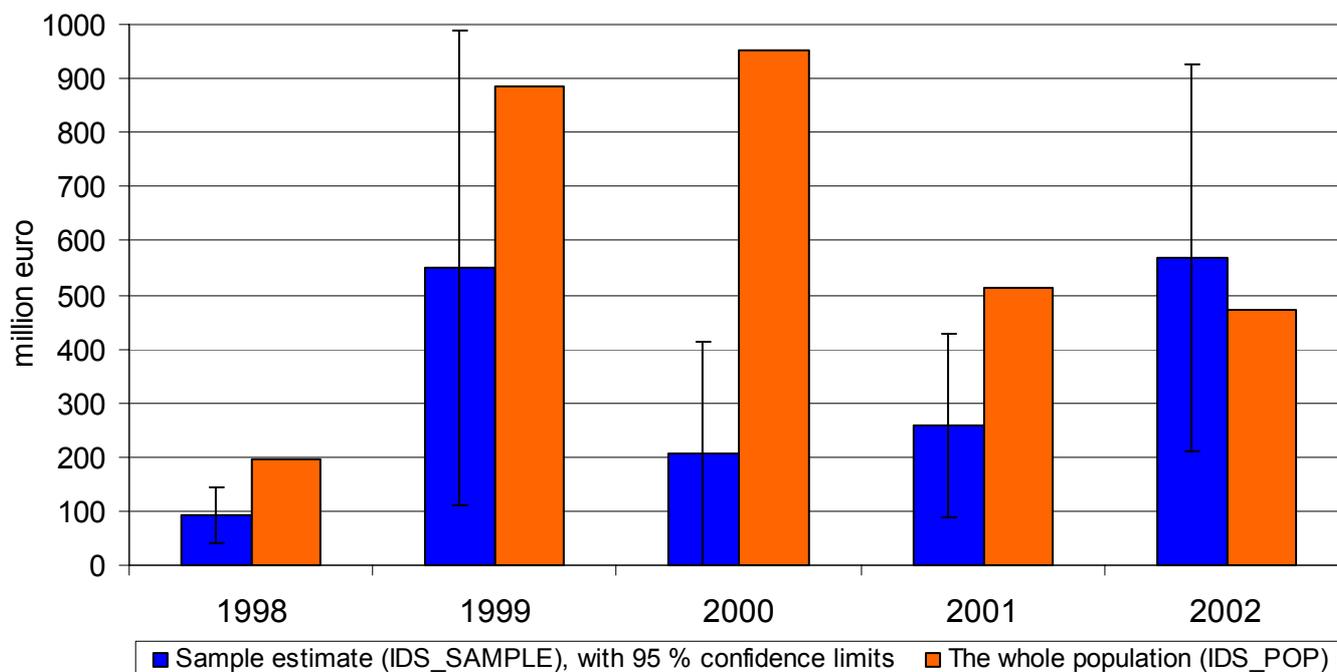
Looking first at the "true" value (IDS_POP), the first observations stands at EUR 0.2 billion. In 1999 and 2000 the total value was almost five-fold. In the bear equity markets of 2001 and 2002, the total amount of stock options was halved. It is likely that the total amounts of 1999 and 2000 will not be reached again, as the Finnish companies using stock options (such as mobile phone maker Nokia) are scaling down the use of stock options⁷.

Turning then to the sample estimates of the total value of stock options, we find that the sample estimates (IDS_SAMPLE) are usually much lower than the known population value (IDS_POP). Estimated confidence limits do not cover the total value in 1998, 2000 and 2001. Relative standard errors are high and even exceed 50 per cent in 2000. This means that the interval estimate includes zero in that year. In the case of stock options, there are no correct representative

⁷ At the end of August 2000, the total value of stock options programmes was EUR 5.9 billion (FIM 35 billion). About 86 per cent of this amount was the value of Finnish mobile phone maker Nokia's stock options programme (Mäkinen). It must be noted that half of the stock options programmes had no value at the end of August 2000.

outliers in the sample data and thus no information on which to base estimates for the outlying observations, i.e. for the very extreme of the income distribution.

Figure 6. Total value of employee stock options (EUR million) and sample survey estimates of total values along with estimates of 95% confidence limits.



It is evident from Figure 6 that a general household survey such as the IDS_SAMPLE may give very biased interval estimates when the variable is extremely left-skewed. Because the contribution of stock options on income inequality depends heavily on their total value relative to overall income, as we shall later see, we will use the data set for the whole population in our calculations.

5. The effect of net stock options on disposable income

In Section 3, the decomposition of Gini coefficient into within source inequality, income share, and correlation components was presented. We next decompose disposable income Gini by the income sources. We first look at the concentration and then at the income shares before turning to actual Gini contributions.

We expect that stock options are very unequally distributed. As stock options and rankings in terms of disposable income should be highly correlated, we also expect the measured Gini correlations to be very high. Consequently, the pseudo-Ginis or concentration coefficients should be high indicating that income is extremely concentrated to the very top of the income distribution. As a result of this, the income inequality attributable to stock options should be explained mostly by the income share.

In addition to stock options, we consider three other income sources: realised capital gains, dividends, and "other" income. Our focus is on the stock options, however. Other income mainly

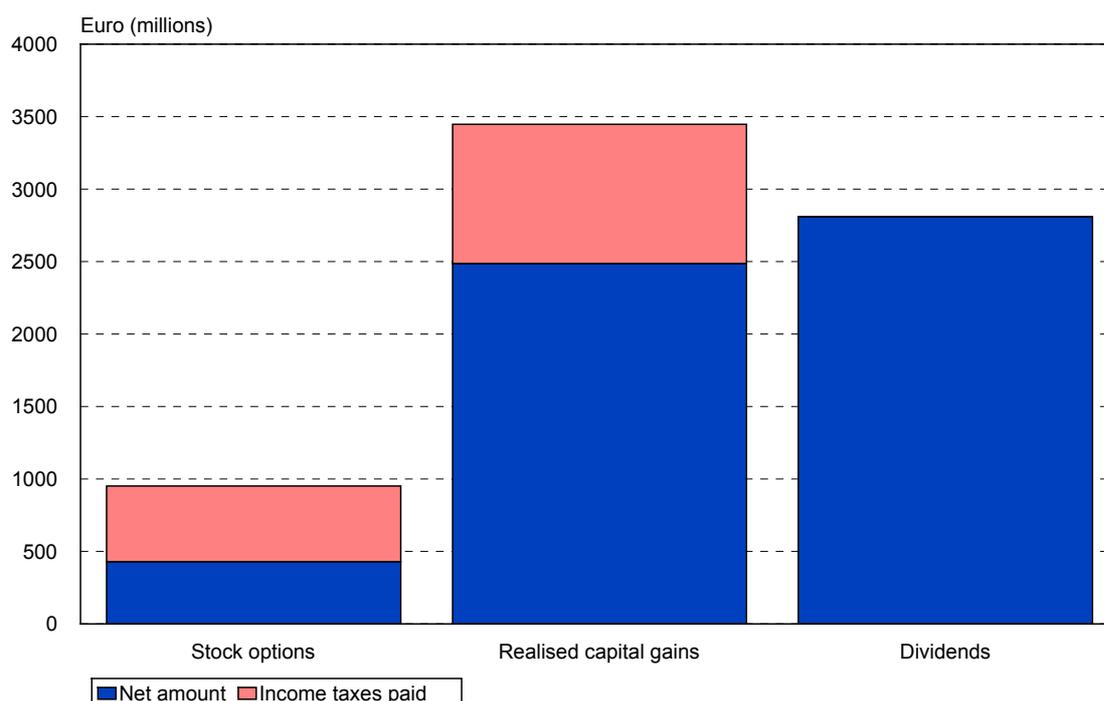
consists of earnings, pensions and other transfers and it is by far the largest income component. Realised capital gains and dividends are taken from the tax files.

It is to be noted that only dividends are included as income in the National Accounts in Finland. Stock options and realised capital gains are treated as changes in assets. In contrast, micro statistics include all the components as household income.

In decompositions, all income sources are measured net of taxes. Transfers paid on the basis of stock options were estimated and deducted from gross stock options income. Stock options are taxed progressively, as earned income⁸. From realised capital gains minus losses, the flat-rate 29 per cent capital income tax was taken off. Dividends are basically tax-free to the households because of the *avoir fiscal* system: the corporation pays the tax on behalf of the recipient. Dividends are measured here without the *avoir fiscal* portion.

Because of progressive taxation, stock options are taxed much more heavily than capital gains, not to speak of dividends which are not taxed at all. This is illustrated in Figure 7 where the taxes paid and the remaining net income are depicted in 2000. The average tax-rate on stock options was 55 per cent while it was 28 per cent on realised capital gains minus losses, and zero for dividends. As a consequence of high tax-rates, the argument that stock options also benefit less well off citizens via taxation was often expressed in the public debate.

Figure 7. Net total amounts and income taxes paid by households in 2000



Source: Income Distribution Statistics for the whole population

⁸ The stock option income recipient pays progressive state tax, almost flat-rate municipal tax and flat-rate health insurance contribution on the stock option income received. In 2003, the highest marginal tax rate was 35% and municipal at the maximum 20% of income. Health insurance contribution was 1.5%. The maximum tax rate on stock option income was then 56.5% of the option income received in 2003. (Helaniemi et al, 123).

We now turn to the concentration of different income sources. As expected, stock options, realised capital gains and dividends are very unequally distributed among the households. Table 2 shows the within source Gini coefficients of the income sources. The Gini of stock options is very close to its maximum value (one) every year. The coefficients of realised capital gains and dividends are also extremely high. If we look at the distribution of stock options among the stock option recipients, i.e. removing the zeros from the stock option income vector, we get a bit lower but still a very high Gini (about 0.9 in 2000).

	Stock options	Realised capital gains	Dividends	Other income	Disposable money income
1998	0.999	0.982	0.982	0.228	0.252
1999	1.000	0.988	0.980	0.233	0.270
2000	1.000	0.982	0.979	0.237	0.284
2001	0.999	0.990	0.978	0.239	0.270
2002	1.000	0.991	0.977	0.240	0.268

Source: Income Distribution Statistics for the whole population

We next take a look at the Gini correlations. Gini correlation takes values between minus 1 and plus 1. In a given year, if the ranking of individuals is the same with stock options as with disposable income, then Gini correlation is plus one⁹. We expect this to be very much the case with stock options because the recipients mostly already have high earned income levels.

The Gini correlations of different income components are presented in Table 3. All correlations are indeed very high. Stock options have correlations close to one, mostly at 0.98 and 0.99. This means that stock options are received by those who would be well off even without them. The Gini correlations of realised capital gains and dividends are somewhat lower but still very high.

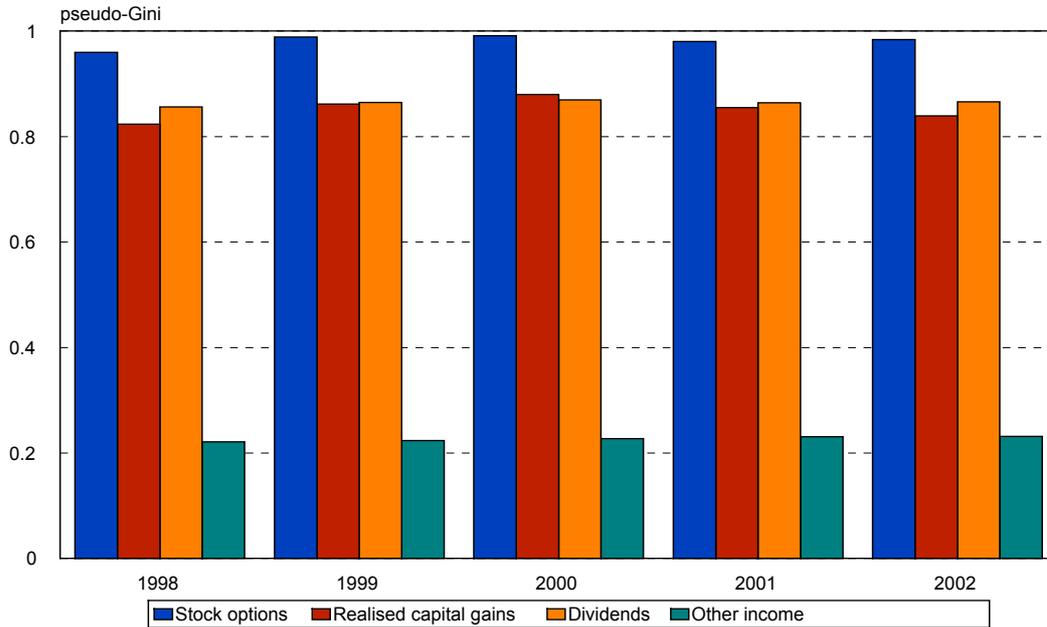
	Stock options	Realised capital gains	Dividends	Other income
1998	0.960	0.838	0.872	0.970
1999	0.989	0.872	0.882	0.960
2000	0.992	0.896	0.889	0.958
2001	0.981	0.863	0.884	0.968
2002	0.984	0.848	0.886	0.966

Source: Income Distribution Statistics for the whole population

Multiplying the Gini correlations with the Gini coefficients of the income components, we get the concentration coefficients (pseudo-Gini coefficients). The concentration of stock options is almost maximal because the concentration coefficient is close to one. Realised capital gains and dividends are also very concentrated to the top. The concentration coefficients are also very stable throughout the period although realised capital gains have slightly more annual variation than dividends and stock options.

⁹ Gini correlation is minus one if the richest person in terms of stock options is the poorest in terms of disposable income, and so on for all persons in the economy.

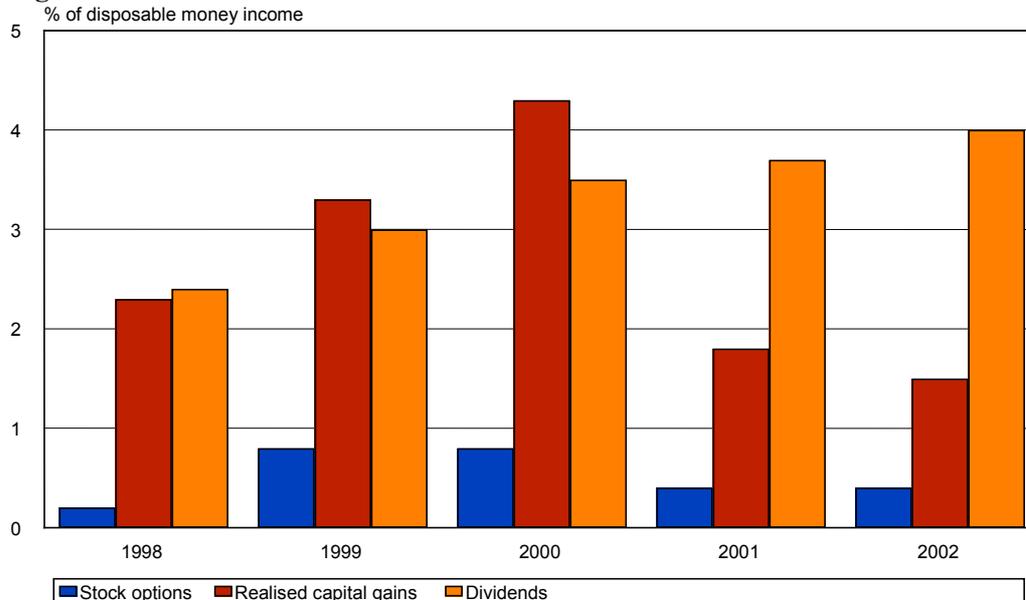
Figure 8. Concentration coefficients (pseudo-Ginis) 1998-2002



Source: Income Distribution Statistics for the whole population

We next turn to income shares (Figure 8). Because stock options are extremely concentrated to the top of the income distribution, their contribution on income inequality depends almost entirely on the income share. The income share of stock options has been small, less than one per cent of disposable income. In 1999 and 2000 it was 0.8 per cent while in 2001 and 2002 it stood at 0.4 per cent.

Figure 8. Income shares 1998-2002.



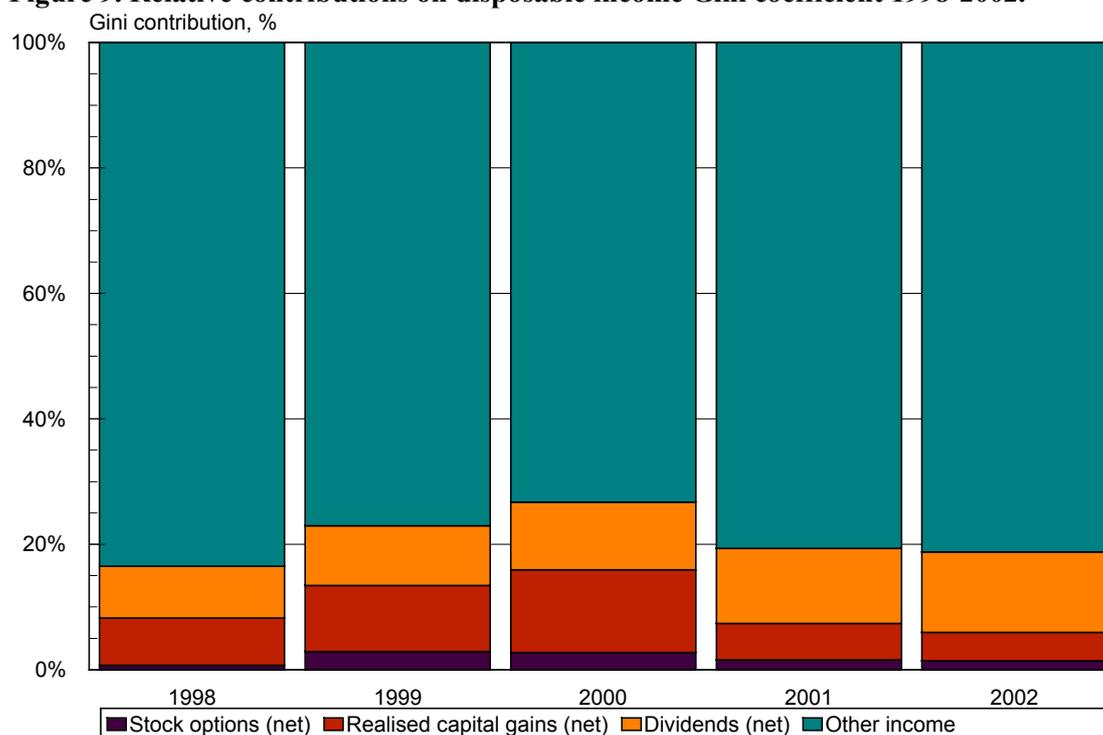
Source: Income Distribution Statistics for the whole population

The income share of dividends has increased every year during the period. In 2002, it stood at four per cent of disposable income. The share of realised capital gains reached its peak, 4.3 per cent, at the height of the stock market bubble, in 2000. After the downturn in the stock market, the total amount of realised capital gains has halved. In 2002, they comprised about 1.5 per cent of disposable income.

Figure 9 finally gives the relative contributions on disposable income inequality. The contribution of stock options appears to be small when we use the Gini coefficient. The contribution increased visibly in 1999 and 2000. The reason for this is a higher income share in those years, as the stock options had only little annual variation in the concentration coefficients.

Other income, mainly earned income and transfers, naturally have by far the biggest contribution because of their large income share. Realised capital gains also became much more important in 1999 and 2000 while dividends have increased their contribution after that as well. Realised capital gains and stock options are directly linked to relative prices in the stock markets. Thus, they were the channels through which the downturn in the equity market affected household incomes after 2000.

Figure 9. Relative contributions on disposable income Gini coefficient 1998-2002.



Source: Income Distribution Statistics for the whole population

The Gini decomposition method can be criticised because there is no explicit reference distribution on which to compare the effect of an income source on inequality (see Cancian & Reed, 1998). We also calculated disposable income Gini with and without stock options to evaluate their effect on disposable income inequality. Thus, disposable income Gini is the actual observed distribution and Gini of disposable income excluding options represents inequality that would occur if no-one had had stock options. The results are presented in Table 4.

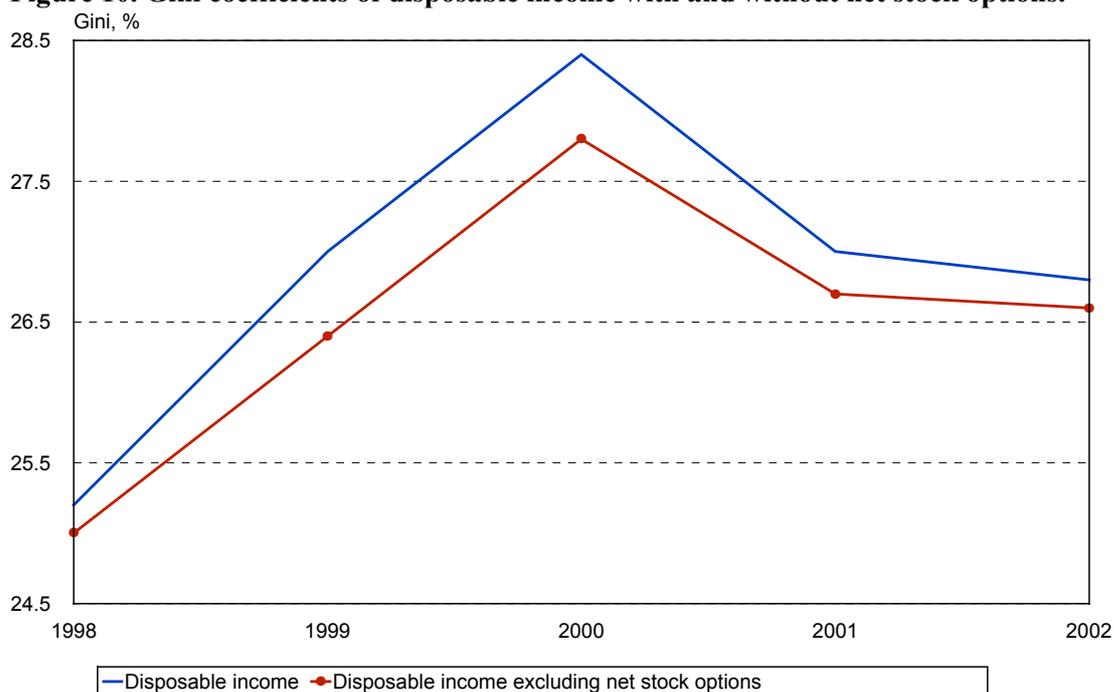
Table 4. Gini coefficients of disposable income with and without net stock options

Level of Gini coefficient x 100	1998	1999	2000	2001	2002
Disposable income	25.2	27.0	28.4	27.0	26.8
Disposable income excluding stock options	25.0	26.4	27.8	26.7	26.6
Difference	0.1	0.6	0.5	0.3	0.3
Change of Gini coefficient x 100	1998	1999	2000	2001	2002
Disposable income	..	1.8	1.4	-1.4	-0.1
Disposable income excluding stock options	..	1.4	1.4	-1.2	-0.1
Difference	..	0.4	0.0	-0.2	0.0

Source: Income Distribution Statistics for the whole population

Without stock options, the Gini coefficient would have been about half a percentage point lower in 1999 and 2000. The trend of income dispersion in those years remains the same: this is highlighted in Figure 10. Income inequality increased in 1999 and 2000 and decreased in 2001 and 2002 with and without stock options. Gini rose about 0.4 percentage points faster because of stock options in 1999. Conversely, in 2001 income inequality was reduced by additional 0.2 percentage points because of stock options.

Figure 10. Gini coefficients of disposable income with and without net stock options.



Source: Income Distribution Statistics for the whole population

The Gini decomposition results and the evidence presented in Figure 10 lead us to conclude that stock options had a relatively minor level effect on overall income inequality in the years 1998 to 2002.

6. Conclusions

Finland experienced a surge in income inequality in the late 1990s. In the official statistics, the rising income share of the top decile was attributed to dividends and realised capital gains, while the public debate often connected rising income inequality to employee stock options.

Empirical evidence on stock options and inequality was weak, however, because conventional sample-based sources on household income distribution could not be used to study stock options reliably. In this paper, a new data source covering the incomes of the whole population was used to study the contribution of stock options on income inequality in Finland.

As expected, stock options were almost perfectly concentrated to the top of the income distribution. Their distribution among the households was extremely unequal and they were received mostly by those with already high income levels. The concentration of stock options was quite stable throughout the study period 1998 to 2002.

As a consequence of the extreme concentration, the income share of stock options mostly determined the share of disposable income inequality attributable to stock options. Because of progressive taxation and high marginal tax rates, the after-tax total of stock options was less than half of gross stock options. This lowered their income share, which was already considerably smaller than that of more lightly taxed dividends and realised capital gains, for example.

Decomposing the Gini coefficient, we found the contribution of income from stock options on income inequality relatively small. In addition, stock options seemed to have mostly only a level effect on income inequality: income inequality would have changed in the same direction with and without stock options. When there were major changes in the income share of stock options, they slightly reinforced the change in inequality. This took place in 1999 and 2001. In 2000 and 2002 stock options did not have any effect on the change of inequality as measured by the Gini coefficient.

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