Mechanisms Behind Intergenerational Earnings Correlation in Finland 1985–2000*

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Abstract

Recent research suggests that both family and community factors are important determinants of the income transmitting process across generations. Solon (2004) formalizes the mechanisms behind intergenerational income correlation. The main purpose of this paper is to empirically clarify the mechanisms behind the intergenerational earnings correlation within this theoretical framework by using a Finnish sample of young men and women. There is evidence for that the intergenerational correlation in earnings have increased somewhat in the 1980s and 1990s. By interpreting the changes in the Finnish society, I argue that the mechanisms behind the correlations have changed during this period. However, some of the effects counteract each other.

Keywords: Intergenerational correlation; Mechanisms behind; Earnings measures

JEL Classifications: J62; D31; D1

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1 Introduction

There has been a rising interest in the study of intergenerational mobility among economists in the last 30 years. This interest has been founded on the availability of data sets suitable for these kinds of studies and by the advancement of statistical techniques. While it was earlier believed that the impact of family background was small (Becker and Tomes, 1986), more recent research has led these beliefs to be revised.

Estimates of the importance of family background on different earnings measures are plentiful (see e.g. Solon (1999) for an overview). Some report estimates of intergenerational income or earnings elasticities, while others report correlations. The estimates clearly differ between countries and to a certain extent within countries as well. As shown in Solon (1992), estimates are sensitive to measurement issues, but differences between countries can hardly be explained by variations in earnings measures, selection criteria or age ranges of the sample. Björklund and Jäntti (1997) use both Swedish and US data and find that intergenerational transmission of earnings is weaker in Sweden than in the US. They suggest that differences in the estimates between countries could be due to connections between cross-sectional and intergenerational inequality. Jäntti et al. (2006) compare the Nordic countries with the UK and the US, and find that the intergenerational earnings persistence is relatively low in the Nordic countries. The comparison shows, that intergenerational earnings persistence is higher in the UK and highest in the US.

Estimates of intergenerational income elasticity in the US range between 0.4 and 0.6 for sons-fathers and for daughters-fathers around 0.4 (Solon, 1992; Chadwick and Solon, 2002; Mazumder, 2001; Jäntti et al., 2006). Estimates for Great Britain are somewhat lower, around 0.3 for both sons-fathers and of daughters-fathers (Blanden et al., 2004; Jäntti et al., 2006).

Canadian estimates of the intergenerational income elasticity are around 0.2 for both pairs of sons-fathers and daughters-fathers (Fortin and Lefebvre, 1998; Corak and Heisz, 1999). Using Nordic data, the estimated earnings elasticities for both sons and daughters are close to the Canadian: the estimates for Denmark are low, under 0.10 (Jäntti et al., 2006), Finnish are less than 0.20 (Österbacka, 2001; Jäntti et al., 2006), Norwegian estimates are around 0.15 (Bratberg et al., 2005; Jäntti et al., 2006), and Swedish estimates range between 0.15 and 0.25 (Björklund and Jäntti, 1997; Østerberg, 2000; Lindahl, 2002; Jäntti et al., 2006). The estimates are lower for daughters than for

sons.

Recently, trends in intergenerational correlation have been estimated. Most estimates come from the US and the results diverge. Some find that the intergenerational correlation has decreased, or no trend at all (Hauser, 1998; Fertig, 2002; Mayer and Lopoo, 2004), while others find that the intergenerational correlation has increased (Levine, 1999; Chadwick, 2002). Some argue that the results depend on the data sets used, or the selection criteria used (Levine and Mazumder, 2002; Chadwick, 2002; Lee and Solon, 2004).

Estimates for Great Britain suggest that the intergenerational income correlation increases over time Blanden et al. (2004). Canadian estimates suggest that the intergenerational correlation in income for both men and women has decreased (Fortin and Lefebvre, 1998). Norwegian estimates show that elasticities in earnings have decreased for sons while the trend is less clear for daughters (Bratberg et al., 2005).

The explanations offered for the observed trends mentioned above are mainly based on changes in educational attainment and returns to education, some also mention the importance of the public sector. Therefore, the only possible conclusion from this survey is that both the choices made by the individuals in the family and the effects of the public sector are important determinants of the income transmitting process across generations. In fact, the knowledge of the mechanisms behind the intergenerational earnings correlation is fairly limited.

Solon (2004) has introduced a theoretical model that offers explanations for at least some of the differences. No one has yet, to my knowledge, interpreted the trends according to that model. The main purpose of this paper is to empirically clarify the mechanisms behind the intergenerational earnings correlation within this theoretical framework. The paper proceeds as follows: in Section 2, the theoretical model is presented. In Section 3, the data set in the analyzes is presented and in Section 4, the analyzes and results are presented and commented upon in Section 5.

2 Theoretical Background

When estimating the intergenerational elasticity, β is estimated by OLS in the model:

$$\ln y_{it} = \alpha + \beta \ln y_{i,t-1} + \epsilon_{it}, \tag{1}$$

where $\ln y_{it}$ is the logarithm of long-run economic status, or permanent earnings component of the grown up child at time t, and $\ln y_{i,t-1}$ is the same variable for the child's parent at time $t-1$. If the standard deviations of the earnings measures are equal for both generations, or is corrected for, the coefficient β equals the intergenerational correlation.

In Solon (2004) a theoretical framework for the mechanisms behind variations in intergenerational correlation is offered. Solon modifies Becker and Tomes (1979) theoretical model of intergenerational mobility, and formalizes the mechanisms behind the intergenerational earnings correlation.

The theoretical framework starts by assuming that the parent's lifetime after-tax earnings, $(1-\tau)y_{i,t-1}$, are allocated between own consumption, $C_{i,t-1}$, and investment in the child's human capital, $I_{i,t-1}$;

$$(1-\tau)y_{i,t-1} = C_{i,t-1} + I_{i,t-1}. \tag{2}$$

By assuming proportional taxes, the only redistributive government policy is represented by progressive public investments in children's human capital.

Assume that parental investments in their child at time $t-1$, $I_{i,t-1}$, together with the government's investment in the child, $G_{i,t-1}$, translates into the child's human capital at time t, h_{it}, according to

$$h_{it} = \theta \ln(I_{i,t-1} + G_{i,t-1}) + e_{it}, \tag{3}$$

where θ represents the productivity of human capital investments in the child, e_{it} is the human capital endowment that the child receives irrespective of the investment choices. The human capital endowment is influenced by both nature and nurture, and can be assumed to follow a first order process

$$e_{it} = \delta + \lambda e_{i,t-1} + v_{it}, \tag{4}$$

where $e_{i,t-1}$ is the parent's endowment and v_{it} can be seen as a white-noise error term. The coefficient λ represents the heritability coefficient. The logarithm of the child's earnings, $\ln y_{it}$, can then be illustrated by

$$\ln y_{it} = \mu + p h_{it}, \tag{5}$$

where p represents the earnings return to human capital.

By formalizing parental behavior, the optimal choice of parental investments in the child's human

capital can be found. Assume that the behavior of the parent can be characterized by a Cobb-Douglas utility function:

$$U_i = (1-\alpha)\ln C_{i,t-1} + \alpha \ln y_{it}, \tag{6}$$

where α is the altruism parameter. By substituting equations 2 to 5 into equation 6, and using the first order condition in order to solve for the optimal choice of investment in the child's human capital, I_{t-1}, we get:

$$I_{i,t-1} = \left[\frac{\alpha\theta p}{1-\alpha(1-\theta p)}\right](1-\tau)y_{i,t-1} - \left[\frac{1-\alpha}{1-\alpha(1-\theta p)}\right]G_{i,t-1}. \tag{7}$$

From this expression, we find some commonly known assumptions. Parents invest more in children when they are more altruistic, and when children's returns to human capital increase. But we can also see that if taxes are constant, public investments partly crowd out parents' investments in children's human capital.

By substituting equations 3 and 7 into equation 5, it can be approximately rewritten as:

$$\ln y_{it} \simeq \mu + \theta p \ln\left[\frac{\alpha\theta p(1-\tau)}{1-\alpha(1-\theta p)}\right] + \theta p \ln y_{i,t-1} + \theta p\left[\frac{G_{i,t-1}}{(1-\tau)y_{i,t-1}}\right] + pe_{it}, \tag{8}$$

where the connection between the child's and parent's earnings depends partly on the public investment in the child's human capital. Assume further that public investments in children can be characterized as:

$$\frac{G_{i,t-1}}{(1-\tau)y_{i,t-1}} \simeq \varphi - \gamma \ln y_{i,t-1}, \tag{9}$$

where γ represents the relative progressivity in public investment in children's human capital. When $\gamma > 0$, the ratio of public investment to parental after-tax income decreases with parental income. The more progressive the policy is, the higher the value of γ. By substituting equation 9 into equation 8, we get the expression:

$$\ln y_{it} \simeq \mu^* + [(1-\gamma)\theta p]\ln y_{i,t-1} + pe_{it}, \tag{10}$$

where μ^* includes μ and a set of the parameters from the earlier equations. In this equation, the error term, pe_{it}, is correlated with $\ln y_{i,t-1}$. By taking this into account, the intergenerational correlation,

β, can be rewritten in steady state as

$$\beta = \frac{(1-\gamma)\theta p + \lambda}{1 + (1-\gamma)\theta p \lambda}. \tag{11}$$

Remembering that λ (from equation 4) is the heritability coefficient, θ (from equation 3) is the productivity of human capital investments, p (from equation 5) is the earnings return to human capital, and γ is progressivity in public investments (compare with equations 9 and 10). The magnitude of the intergenerational correlation depends on the influence of the factors in the decomposition. Differences in the estimate of β between countries and also within countries can consequently be explained by differences in the mechanisms behind the correlation.

By extending the argument of the decomposition of β in equation 11, (Solon, 2004) points out that the intergenerational correlation increases as the heritability of income generating traits, λ, is larger, the human capital investment in children, θ, is more productive, the rate of earnings return to human capital, p, is greater, and as public investment in children's human capital, γ, is less progressive. Furthermore, the model predicts that higher cross-sectional earnings inequality is connected to higher intergenerational earnings correlation. This is explained by the fact that higher rate of earnings return to human capital is connected to higher cross-sectional earnings inequality in a society, as shown in Juhn et al. (1993).

Cross-sectional earnings inequality decreased in Finland in the 1970s, was stable and even decreasing in the 1980s and in the beginning of the 1990s. After the mid-1990s the inequality started to increase (see e.g. Uusitalo (1989) and Jäntti and Ritakallio (1997)). The rate of earnings return to human capital investments decreased strongly in the 1970s and continued at a slower pace in the mid-1980s. In the latter half of the 1980s, returns to human capital were stable and started to decrease again in the beginning of the 1990s (Asplund, 1999). Public investments in human capital increased dramatically during this period. Finland became a social democratic[1] welfare state in the 1960s, which expanded particularly in the 1980s. These factors all lead to the conclusion that the intergenerational earnings correlation should have decreased. However, the model also includes a heritability component and productivity of human capital, which have not been discussed yet. Before moving on to the analyzes of the Finnish data according to the presented model, the data is briefly

[1] compare with the welfare typology by Esping-Andersen (1999).

presented.

3 Data Set

The data used in this paper originate from the quinquennial censuses in Finland from 1970 to 2000. Families are selected in the first three waves of the panel when the children are 14–16 years of age. Younger children would be too young when their own earnings are observed 15–20 years later. Older children, on the other hand, could have left their homes already, and thereby would not be observed. In these three cohorts, the individuals are 29–31/34–36 years old in 1985/90, 1990/95 and 1995/2000 respectively, when their earnings are observed. They have moved from their parents' house before their earnings are observed for the first time. Their parental earnings are observed in 1970/75, 1975/80, and 1980/85 respectively.

Since censuses are household-based, the original data set contains information on social families. The head and spouse are considered to be the father and the mother of the children in the social family when the family is selected (in 1970, 1975 and 1980 respectively). Single-parent families are also included.

In the empirical estimates of the intergenerational earnings correlations, I use both individual and family earnings measures. Individual earnings are defined as including wages, salaries, and income from self employment. Family earnings is the sum of all individual earnings in the family. In the analyzes, the earnings measures are both included as such and equivalized. The equivalence scale I use is of the following form:

$$E = \frac{H}{(N_1 + \alpha N_2)^{\epsilon}}, \tag{12}$$

where H is total earnings (individual or household), N_1 is the number of adults, N_2 is the number of children. The parameter α equals 0.7 and ϵ equals 0.85.

In Table 1, descriptive statistics are shown for the three cohorts. The mean of yearly earnings are more or less constant over the years or even decreasing. The depression in the early 1990s in Finland actually decreased the level of disposable earnings and the unemployment rate was extremely high, especially among young individuals. The Finnish economy recovered relatively fast, but not the economy of individuals. Unemployment was still high in 2000, the unemployment rate among men was 9.1 percent and among women 10.6 percent (*Statistical Yearbook of Finland*, 2004).

Women's individual earnings are much lower on average than men's, and their equivalent family earnings are also slightly lower than men's. These women are in their prime years for child bearing and quite many are probably on maternity leave during some part of the year, i.e. low yearly earnings which can not be controlled for. They have also larger families on average, which contributes to the slightly lower equivalent family earnings. The economic status of their own family is therefore highly relevant for the economic situation. Equivalent family earnings are lower than individual earnings for men, in contrast to the case for women, which indicates that men are the main breadwinners in the households.

An individual is selected if he/she has left his/her parental home before the age of 29–31. Daughters seem to leave earlier, since the sample size of women is larger than the sample size of men. The mean age of the samples increases over the years, implying that children leave their parental homes at a somewhat younger age in the earlier cohorts than in the later. Women also have children at a younger age than men. The number of children in their families is larger for women than for men.

The level of education increases over the years. Womens' educational attainment in particular show an increase. In 1995, women have a remarkably high educational achievement. 41.5 percent of the women have a degree on the tertiary level, compared to 29.7 percent of the men.

In Table 2, descriptive statistics for the parents of the three cohorts are shown. The mean age for the fathers is about 46 and for the mothers about 43 in all three cohorts. Mean family size decreases quite dramatically during these years, from 5.7 on average in 1970, to 4.6 on average in 1980. The average number of children in the families decreases from 3.7 in 1970, to 2.7 in 1980, and at the same time the number of single mothers increases.

The mothers are more likely to have only compulsory education or education at a secondary level compared to the fathers. During this period, parental education increases, especially among the mothers.

Parents' earnings in their forties are lower than their children's earnings in their early thirties, and the variation is higher among parents. Mean earnings increased in the 1970s and 1980s at the same time as the inequality in earnings decreased in the 1970s and remained low in the 1980s, but increased again in the middle of the 1990s. The individual mean earnings of the mothers are substantially lower than mean earnings of the fathers. The mean of equivalent family earnings of mothers and fathers are quite similar (differs with 3-5 log percent in the three cohorts). Most of the

Table 1: Descriptive statistics for the sample

Variable	Cohort 1 observed in 1985 Mean	Std Dev	N	Cohort 2 observed in 1990 Mean	Std Dev	N	Cohort 3 observed in 1995 Mean	Std Dev	N
				Men					
Age	29.88	(.88)	5755	30.01	(.82)	5638	30.18	(.89)	5236
Mean ln individual earnings*	9.87	(.61)	5548	9.85	(.68)	5326	9.84	(.78)	4819
Mean ln eq. fam. earnings*	9.46	(.56)	5562	9.44	(.67)	5364	9.48	(.77)	5236
Family size	2.97	(1.26)	5755	2.82	(1.30)	5638	2.71	(1.37)	5236
Adults in the family	1.85	(.36)	5755	1.82	(.39)	5638	1.77	(.42)	5236
Children in the family	1.12	(1.06)	5755	1.00	(1.09)	5638	0.94	(1.13)	5236
Only compulsory education %	25.8		1487	18.8		1062	17.8		930
Secondary education %	46.8		2691	52.1		2936	52.5		2749
Tertiary education %	27.4		1577	29.1		1640	29.7		1553
				Women					
Age	29.88	(.87)	6448	30.00	(.81)	6166	30.19	(.90)	5810
Mean ln individual earnings*	9.30	(.81)	6141	9.26	(.87)	5779	9.27	(.92)	5297
Mean ln eq. fam. earnings*	9.38	(.60)	6319	9.35	(.68)	6010	9.37	(.81)	5557
Family size	3.23	(1.27)	6448	3.15	(1.36)	6166	3.01	(1.37)	5810
Adults in the family	1.83	(.37)	6448	1.81	(.39)	6166	1.76	(.43)	5810
Children in the family	1.40	(1.09)	6448	1.34	(1.17)	6166	1.24	(1.18)	5810
Only compulsory education %	26.1		1685	15.3		946	12.7		738
Secondary education %	44.8		2890	50.9		3139	45.8		2660
Tertiary education %	29.1		1873	33.8		2081	41.5		2411

Note: All earnings are in 2000 EURO.

Note: *) Mean earnings are from 1985 and 90 when children are observed in 1985, from 1990 and 95 when observed in 1990, and from 1995 and 2000 when observed in 1995.

parents are living together, and have the same equivalent earnings. Among mothers there are more single parents than among men, and single mothers have low earnings on average.

4 Analyzes and Results

4.1 Intergenerational Correlation across Time

Intergenerational earnings correlation are estimated using equation 1, where parental age and age squared are included. Since the children's ages differ with only 3 years, their own ages are not controlled for. The earnings measures are a two year mean of earnings.[2] Both individual and family earnings are used in the estimations. Individual earnings is a measure of success at the labor market, while family earnings is an estimate of an individual's actual economic status.

When children's equivalent family earnings is the dependent variable, the parental earnings measures are also equivalized. The earnings measures are corrected for differences in variances and the estimated correlations are shown in Table 3. The corresponding elasticities can be found in Table 4.

Earlier estimates of intergenerational earnings correlation in Finland show that when using individual earnings as the dependent variable, estimates are somewhat lower for daughters and parents than for sons and parents. When a measure of both parents' earnings is used as the independent variable, the estimates are higher than using either father's or mother's earnings separately.[3] We can see somewhat similar patterns in Table 3, and the estimates are in the same range as the previous Finnish estimates (Österbacka, 2001).

The relationship with lower correlations for daughters than for sons changes when equivalent family earnings are used as the dependent variable. The correlations in equivalent family earnings between daughters-parents and between sons-parents are at the same level, and higher than when earnings measures are not equivalized. This implies that due to the choices of partner and stage of life, the family earnings of these young men and women are more highly correlated to the earnings of their original family than their individual earnings are. Chadwick and Solon (2002) show that

[2]Grawe (2003) and Haider and Solon (2004) show that an annual observation of the child's earnings is not a good proxy for the child's long-run earnings and the estimate of the intergenerational correlation will be biased. A mean of several years is a better proxy for long-run earnings.

[3]This result is an interesting contrast to Blanden et al. (2004), who find that the use of family income rather than fathers' earnings as the independent variable results in lower estimates of the intergenerational correlation in earnings for both men and women. This difference could be due to lower labor force participation among mothers in Great Britain than in Finland.

Table 2: Descriptive statistics for the parents

	Cohort 1 observed in 1970			Cohort 2 observed in 1975			Cohort 3 observed in 1980		
Variable	Mean	Std Dev	N	Mean	Std Dev	N	Mean	Std Dev	N
				Fathers					
Age	46.32	(7.14)	10821	46.22	(7.19)	10152	45.78	(7.26)	9172
Mean ln individual earnings*	9.54	(.84)	6645	9.66	(.87)	6575	9.64	(.90)	7389
Mean ln eq. ind. earnings*	8.30	(.89)	6645	8.46	(.91)	6575	8.54	(.92)	7389
Mean ln family earnings*	10.07	(.62)	9193	10.23	(.62)	8505	10.29	(.63)	8569
Mean ln eq. fam. earnings*	8.89	(.62)	9193	9.06	(.62)	8505	9.20	(.61)	8569
Family size	5.68	(1.88)	10821	5.14	(1.59)	10152	4.67	(1.35)	9172
Adults in the family	1.98	(.13)	10821	1.98	(.14)	10152	1.97	(.16)	9172
Children in the family	3.69	(1.87)	10821	3.16	(1.58)	10152	2.70	(1.33)	9172
Single fathers %	1.64		178	2.13		216	2.78		255
Only compulsory education %	79.2		8565	72.8		7392	63.4		5811
Secondary education %	10.4		1127	13.6		1379	18.9		1732
Tertiary education %	10.4		1129	13.6		1381	17.8		1629
				Mothers					
Age	43.60	(6.31)	11689	43.73	(6.47)	11210	43.33	(6.56)	10438
Mean ln individual earnings*	8.56	(1.12)	6094	8.82	(1.12)	7414	9.03	(.99)	8363
Mean ln eq. ind. earnings*	7.45	(1.17)	6094	7.57	(1.17)	7414	7.97	(1.03)	8363
Mean ln family earnings*	10.02	(.66)	9895	10.16	(.67)	9288	10.21	(.69)	9715
Mean ln eq. fam. earnings*	8.86	(.65)	9895	9.02	(.64)	9288	9.15	(.64)	9715
Family size	5.58	(1.91)	11689	5.02	(1.62)	11210	4.53	(1.40)	10438
Adults in the family	1.91	(.29)	11689	1.89	(.32)	11210	1.85	(.35)	10438
Children in the family	3.67	(1.87)	11689	3.14	(1.57)	11210	2.68	(1.33)	10438
Single mothers %	8.95		1046	11.4		1274	14.6		1551
Only compulsory education %	83.8		9808	77.2		8659	67.6		7059
Secondary education %	11.1		1294	15.0		1681	21.2		2211
Tertiary education %	5.0		587	7.8		870	11.2		1168

Note: All earnings are in 2000 EURO.

Note: *) Mean earnings are from 1970 and 75 when parents are observed in 1970, from 1975 and 80 when observed in 1975, and from 1980 and 85 when observed in 1980.

because of assortative mating, the correlation between daughter's family earnings and her parents' earnings, in fact, is mainly accounted for by her husband's earnings. Since husbands usually are the main breadwinners in the families, their earnings are influential in this respect.

The correlation in individual earnings seems to increase during the time period studied. When equivalent family earnings are used as earnings measures, there is no obvious trend. To test whether the trends are statistically significant, the following model is estimated:

$$\ln y_{it} = \alpha + \beta \ln y_{i,t-1} + \psi(\ln y_{i,t-1} \times \text{year}_{it}) + \omega \ \text{year}_{it} + \epsilon_{it}, \tag{13}$$

where year_{it} is a dummy variable for the observed years. The coefficient ω tells us whether earnings have changed over time, and the coefficient ψ tells us whether the effect of parental earnings has changed over the years, i.e. the trend effect. The estimated intergenerational elasticities and the trends are presented in Table 4.[4] Some coefficients for the trend effects are significant. An F-test for significant trends shows that the coefficients for the trend effects are positive and significant when family earnings are used as the independent variable. When fathers' earnings is the independent variable, there is no significant trend. When mothers' earnings is the independent variable, there is a positive trend in two cases; when sons' mean equivalent family earnings and when daughters' mean individual earnings are used as dependent variables. These results indicate that a measure of both parents' earnings is more important than when using either father's or mother's earnings. However, the impact of mothers' earnings has also increased.[5]

In the decomposition of the intergenerational correlation, presented in equation 11, there are four components presented. All of the four components, or some of them, might have changed, which would imply changes in the correlation over time. By investigating the different components in a time perspective, it is possible to receive insight into the mechanisms behind the intergenerational correlation. Some of the changes in the mechanisms behind the intergenerational correlation can be tested empirically.

[4]The trend effect is estimated on elasticities since this is econometrically easier. Estimations on correlations should take differences in standard deviations over the years into consideration.

[5]When the same estimates are (erroneously) done for trends in correlation, the effects are less clear, which is probably due to the differences in standard deviation of the earnings measures over the years.

Table 3: Intergenerational correlation (standard error), [Number of observations]

Child's Earnings Measure	Independent earnings measure: 1985 Family	1985 Father's	1985 Mother's	1990 Family	1990 Father's	1990 Mother's	1995 Family	1995 Father's	1995 Mother's
Sons									
Individual earnings measures									
Individual	0.150	0.167	0.074	0.165	0.198	0.110	0.183	0.178	0.088
	(.014)	(.017)	(.019)	(.015)	(.017)	(.017)	(.016)	(.017)	(.017)
	[4,634]	[4,139]	[2,634]	[4,465]	[3,937]	[3,809]	[3,998]	[3,566]	[3,909]
Equivalent earnings measures									
Equivalent	0.230	0.212	0.134	0.218	0.198	0.123	0.253	0.180	0.133
Family	(.016)	(.016)	(.020)	(.017)	(.017)	(.016)	(.018)	(.017)	(.016)
	[4,645]	[4,149]	[2,639]	[4,496]	[3,965]	[3,835]	[4,034]	[3,595]	[3,949]
Daughters									
Individual earnings measures									
Individual	0.105	0.105	0.079	0.153	0.113	0.131	0.177	0.138	0.152
	(.013)	(.020)	(.017)	(.015)	(.020)	(.016)	(.017)	(.019)	(.016)
	[4,831]	[2,708]	[3,599]	[4,358]	[2,920]	[3,964]	[4,289]	[3,627]	[4,242]
Equivalent earnings measures									
Equivalent	0.227	0.198	0.131	0.265	0.175	0.145	0.267	0.174	0.138
Family	(.015)	(.019)	(.016)	(.016)	(.019)	(.016)	(.016)	(.017)	(.015)
	[4,976]	[2,781]	[3,704]	[4,532]	[3,020]	[4,106]	[4,478]	[3,786]	[4,439]

Note: All earnings are in 2000 EURO.

Table 4: Test for trend in intergenerational elasticity (standard error)

Independent variables	Sons' dependent earnings measure		Daughters' dependent earnings measure	
	Mean eq. family	Mean individual	Mean eq. family	Mean individual
Also included	Age and age squared of the father			
Mean eq. family earnings	0.193		0.208	
	(.015)		(.015)	
Mean family earnings		0.152		0.149
		(.015)		(.019)
Trend 90	0.003	0.021	0.036	0.054
	(.021)	(.021)	(.021)	(.026)
Trend 95	0.097	0.067	0.103	0.090
	(.021)	(.022)	(.022)	(.026)
Dummy for 1990	-0.066	-0.255	-0.378	-0.613
	(.185)	(.213)	(.192)	(.266)
Dummy for 1995	-0.918	-0.747	-1.011	-0.978
	(.194)	(.220)	(.196)	(.265)
N observations	14,625	14,531	15,749	15,159
F-test for both	12.94	5.08	11.49	5.93
trends=0 [p-value]	[.000]	[.006]	[.000]	[.003]
Also included	Age and age squared of the father			
Mean father's eq. earnings	0.131		0.135	
	(.012)		(.014)	
Mean father's earnings		0.120		0.109
		(.013)		(.020)
Trend 90	0.009	0.031	-0.001	0.006
	(.016)	(.018)	(.020)	(.028)
Trend 95	0.024	0.036	0.021	0.032
	(.016)	(.018)	(.019)	(.026)
Dummy for 1990	-0.101	-0.330	-0.032	-0.114
	(.134)	(.170)	(.166)	(.269)
Dummy for 1995	-0.189	-0.365	-0.276	-0.399
	(.136)	(.169)	(.159)	(.251)
N observations	11,709	11,642	9,587	9,255
F-test for both	1.16	2.39	0.91	0.90
trends=0 [p-value]	[.313]	[.092]	[.402]	[.408]
Also included	Age and age squared of the mother			
Mean mother's eq. earnings	0.059		0.073	
	(.010)		(.010)	
Mean mother's earnings		0.038		0.065
		(.011)		(.013)
Trend 90	0.009	0.026	0.013	0.036
	(.014)	(.015)	(.014)	(.018)
Trend 95	0.041	0.031	0.032	0.073
	(.015)	(.016)	(.015)	(.019)
Dummy for 1990	-0.132	-0.286	-0.142	-0.384
	(.104)	(.131)	(.107)	(.157)
Dummy for 1995	-0.384	-0.350	-0.307	-0.736
	(.113)	(.141)	(.114)	(.169)
N observations	10,423	10,352	12,249	11,805
F-test for both	4.49	2.26	2.42	7.23
trends=0 [p-value]	[.011]	[.104]	[.089]	[.001]

Note: All earnings are in 2000 EURO.

4.2 Heritability

The first possible test is to check whether there has been any changes in heritability of income generating traits, which is represented by λ in equation 11. If parents become more alike, i.e. if the mating process displays greater homogeneity, heritability traits becomes stronger. Let us test for changes.

An individual's human capital is influenced by nature and nurture, and an individual's productivity is based on his/her human capital. The individual's human capital, therefore, corresponds to his/her earnings. Education is an important measure for the human capital of an individual and in this case, education of the parents serves as a proxy for their human capital. Educational homogamy in a couple is also a measure of assortative mating.

In Table 5, a cross tabulation of parents' education is shown. It is clear that parents choose their partners from the same educational level. The fraction of parents on the diagonal have increased slightly over the years; 48.6, 50.4 and 50.5 percent of the parents have the same educational level in 1970, 1975, and 1980 respectively. In this respect, there has been a small change. The educational level of parents also increases, especially the level of education of the mother. Parents with only compulsory education is by far the largest group in both cohorts (the (1,1) element of the diagonal), but elements (2,2) and (3,3) increase over the years.

The sum of the elements in the upper triangle (i.e. the mother has higher education than the father) increases from 15.2 in 1970, to 21.6 in 1975, and to 29.6 in 1980. If the educational level of the mother is important for children, there has been a shift during this period. US findings show that higher educated mothers spend more time with their children (playing with them, reading to them or helping with their home work). These activities by the mothers are connected to fewer behavioral problems of their children and higher grades in school (see e.g. Zick et al., 2001). These two results indicate, weakly, that the heritability of income generating traits has increased.

Another possible way of explaining changes in income generating traits, λ, is that abilities differ between different groups of the population. If these abilities are appreciated differently on the labor market, or even discriminated against, the economic outcomes of different groups might differ. Support for this hypothesis can be found in e.g. Björklund et al. (2002), where the brother correlation in the US is estimated at 0.43, but decreases to 0.32 when blacks are excluded. Finland has been and still is a very homogeneous society, and is unlikely to be affected by this hypothesis.

Table 5: Cross table of educational level among fathers and mothers where both parents present the year they are selected

Father's education	Mother's education: Compulsory education	Education at 2nd level	Education at 3rd level	Row %
	In 1970, N = 10,643 and χ^2=2302.2			
Compulsory %	89.9	8.5	1.6	79.8
2nd level %	71.4	23.5	5.1	10.4
3rd level %	47.8	19.9	32.3	10.5
Column %	83.6	11.2	5.2	100
	In 1975, N = 9,936 and χ^2=2446.3			
Compulsory %	85.6	12.0	2.3	72.8
2nd level %	66.0	26.6	7.3	13.6
3rd level %	39.8	21.1	39.0	13.6
Column %	76.7	15.3	8.0	100
	In 1980, N = 8,917 and χ^2=2092.2			
Compulsory %	78.3	17.7	4.0	63.2
2nd level %	61.2	30.9	7.9	18.9
3rd level %	33.7	24.0	42.3	17.9
Column %	67.0	21.4	11.6	100

Note: $\chi^2_{1\%}$ with 4 degrees of freedom is 13.3. A larger value of the χ^2 indicates non-randomness in the contingency table.

The results indicate that the heritability of income generating traits has increased slightly during the time period studied. Consequently, this could contribute to explaining the increasing trend in earnings correlation.

4.3 Earnings Return to Human Capital

The other obvious test that needs to be done, is to check whether earnings return to human capital has changed, which is represented by p in equation 11. Education serves as a proxy for the level of human capital in this test as well. Asplund (1999) sums up the trend in the returns to education in Finland. The average return to education declined in the first half of the 1980s, and remained constant or even increased at the highest educational level in the second half of the 1980s. In the beginning of the 1990s the average return to education declined again due to the recession in the Finnish economy.

By including individual's level of education, educ_{it}, as an explanatory variable in an earnings equation and dummies for years, changes in returns to human capital can be detected. The following model is estimated for the "children":

$$\ln y_{it} = \alpha + \xi\ \text{educ}_{it} + \varpi(\text{educ}_{it} \times \text{year}_{it}) + \omega\ \text{year}_{it} + \epsilon_{it}, \tag{14}$$

where the coefficient ϖ shows whether the returns to education have changed.

The results are shown in Table 6, where two different models are estimated for men and women. The first model includes only education and in the second model, both education and socio-economic status are included.

The R^2's are at the same level when only education is included in the model for both men and women, but increases more for men than for women when socio-economic status is included. However, the standard deviation of earnings is higher among women than among men. Education is consequently a more important characteristic for women's earnings while socio-economic status is a more important characteristic for men's earnings.

Returns to education at the secondary level have increased for men. The trends are positive and clearly significant, in both models, but the coefficients for the trends decrease in the second model. The trend coefficients for education at a tertiary level are positive in the first model, but negative in

the second. For women, the only significant trends are in the first model, where the trend coefficients for education at a tertiary level are positive. In the second model, these coefficients are negative, but not significant.[6]

Education at a secondary level has become more rewarding for these young men. The corresponding coefficients for women indicate the same, but they are not significant. The results for education at a tertiary level are not that clear. The trend is positive and significant for both men and women in the first model where only education is included, but becomes negative when occupational status is included, and not even significant for women. In the second model, occupational status seem to pick up the trend for education at the tertiary level. Usually the estimated coefficients for educational attainment are reduced by almost one half when socio-economic status is included into the models. The socio-economic classification relies on the acquired education to a large extent, and a "good" education leads to a "good" job and "good" earnings (Asplund, 1999, 2001). In the present estimates, the coefficients for educational attainment are almost the same with or without socio-economic status included. If these young individuals have a "good" education and received a "good" job, that job seem to determine the development of their earnings.

If we only look at the first model, returns to education have increased for men and the results indicate the same for women. If we include socio-economic status, the results become less clear. The results form the first model, could contribute to explaining the increasing trend in earnings correlation.

4.4 Productivity of Human Capital and Progressivity in Public Investments

There are no obvious tests for checking whether human capital investments in children have become more productive or whether the progressivity in public investments in children's human capital has changed, represented by θ and γ respectively in equation 11. However, these two facts are likely to be related. Finland has a long tradition of a school system financed by the public sector. There was already legislation about compulsory basic education in 1866. After that, the educational system has changed and developed.

In 1958, the compulsory basic education became eight years long in the whole country. In that

[6]These results are in contrast to Asplund (1999). Asplund refers to more representative samples, not only young individuals as in this paper.

Table 6: Test for trend in returns to educational level (standard error)

Independent variables	Dependent earnings variable			
	Men's earnings		Women's earnings	
Constant	9.73	9.74	9.14	9.13
	(.018)	(.016)	(.021)	(.020)
Education	0.048	0.050	0.054	0.049
at 2nd level	(.022)	(.020)	(.027)	(.025)
Trend 1990	0.071	0.046	-0.007	0.001
	(.033)	(.030)	(.042)	(.040)
Trend 1995	0.198	0.104	0.064	0.039
	(.035)	(.032)	(.046)	(.044)
Education	0.417	0.410	0.464	0.422
at 3rd level	(.024)	(.023)	(.029)	(.028)
Trend 1990	0.097	-0.111	0.047	-0.095
	(.036)	(.038)	(.045)	(.045)
Trend 1995	0.194	-0.064	0.141	-0.023
	(.038)	(.038)	(.048)	(.047)
Self employed		-0.213		-0.273
		(.127)		(.265)
Higher white		0.091		0.521
collar		(.052)		(.075)
Lower white		-0.000		0.371
collar		(.054)		(.046)
Farmer		-0.300		0.433
		(.130)		(.324)
Unknown		-0.980		-0.472
status		(.075)		(.118)
Also included		trends		trends
		for soc.ec.		for soc.ec.
		status		status
Dummy for 1990	-0.098	0.011	-0.080	-0.076
	(.027)	(.027)	(.036)	(.038)
Dummy for 1995	-0.209	0.073	-0.181	-0.025
	(.029)	(.029)	(.040)	(.044)
F-test for trends in	16.29	5.27	1.19	0.44
educ. at 2nd level=0	[0.0001]	[0.0052]	[0.3028]	[0.6452]
F-test for trends in	13.11	4.43	4.33	2.29
educ. at 3rd level=0	[0.0001]	[0.0120]	[0.0132]	[0.1018]
N	15,693	15,693	17,217	17,217
R^2	0.0803	0.2255	0.0686	0.1628

Note: All earnings are in 2000 EURO.
Note: Numbers in [ ] represent p-values.

system, children began school the year they turned seven. After three to five years of education, children had to chose if they wanted to continue with a higher and more theoretical education in order to get a matriculation exam (graduate from the gymnasium or receive the matriculation exam, which is similar to graduation from senior high school[7]), or to complete the compulsory eight years of education and eventually continue with some vocational education. After choosing, pupils were separated and received a somewhat different education during the rest of the compulsory school system. Those who had chosen the more theoretical route, continued on to the gymnasium after the eight compulsory years and almost all continued on to university. The gymnasiums were quite few, and not all pupils could live with their parents during the semesters. The expenses for sending a pupil far away from home was not possible for many families. The choice for a child's education was highly dependent on where the family lived and on their economic situation (Lampinen, 2000).

In the 1960s, the lack of equality in the educational system was widely debated. Partly as a consequence of this debate the number of gymnasiums increased sharply in the 1960s and 1970s and the compulsory education was reorganized completely in 1972-77. The compulsory education system became the same for everyone and lasted for nine years. After these nine years of basic education, pupils were able to chose between leaving school, some kind of vocational education, or the gymnasium. The only possibility of being accepted into the universities was by passing the matriculation exam. Vocational education at higher levels developed and the possibility of being accepted into these establishments was either a completed vocational education at a lower level, or the matriculation exam (Lampinen, 2000).

Both the number of gymnasiums and universities expanded greatly in the 1960s and 1970s. The number of students with matriculation exams increased as did the number of students at universities. However, the ratio of students with a matriculation exam to new university students decreased. In 1960, 81 percent of those who received a matriculation exam were admitted to the university. In 1965, this number decreased to 77 percent, in 1970 to 55 percent, in 1975 to 50 percent and in 1980 and 1985 to 39 percent. Even though admission into universities became more competitive, the 1960s was the period when studying at universities became available for everyone. The expansion of the gymnasiums and universities implied that the matriculation exam and university studies became an option for all social groups (Blomster, 2000).

[7]I will refer to "the gymnasium" later on in the text

These changes affected the different cohorts in this study differently. The oldest cohort completed their compulsory education before the reorganization of the compulsory education. Their decision on further education was made when they were about 11 years old (mid-1960s) before the large increase in the number of gymnasiums and universities. Their decision was, therefore, largely determined by their parents. The new school system applied to the youngest cohort and they decided upon their further education, at the age of 15, in the beginning of the 1980s, when higher education was available for everyone. The middle cohort could belong to either of the systems of compulsory education, since the reorganization was applied earlier in some regions and was completed finally in 1977 when the youngest of the middle cohort finished their compulsory education. Their early school years were also in the midst of the expansion period for higher education. The youngest cohort had more equal opportunities in the educational system than the oldest cohort, and their educational decisions could be based on their individual abilities to a large extent.

Another reform that affected the cohorts differently was the system of study grants and loans guaranteed by the state. In 1969, a financial aid system was introduced. This system was based on study loans granted by banks but subsidized and guaranteed by the state. In 1976, the banks reduced the number of loans granted. Study grants were introduced in 1972, and after 1976, the grant was raised slightly every year and an accommodation allowance was introduced as a complement to the grant. In the 1970s, the loan covered about half of the average student's income needs. Individual earnings covered on average about 30 percent, while the share of parents' contribution was around 10 percent (in the 1960s this share was 30–40 percent). Study grants covered only a small proportion of the average student's income need. In the 1980s, the loan covered about 20 percent of the average student's income needs, while individual earnings covered closer to 50 percent. Parents' contribution was still about 10 percent, and study grants still covered only a small proportion of the average student's income needs (Blomster, 2000).

When the oldest cohort made their educational choice in the mid 1960s, they had to rely on their parents' economic situation to a large extent, since the study grants and loan systems were not developed yet. When the youngest cohort made their decision about their further education in the early 1980s, they were less dependent on their parents. Even if study grants and loans covered only a small proportion of the average student's income needs at that time, the system existed and formed a safety net.

Table 7: Development of the educational system

	Cohort 1 observed in 1985	Cohort 2 observed in 1990	Cohort 3 observed in 1995
Born	1954-56	1959-61	1964-66
Compulsory education started	1961-63	1966-68	1971-73
Lasted for	8 years	8/9 years	9 years
The old system	Choice between gymnasium or only compulsory education at 3rd, 4th or 5th grade		
Reorganization in 1972-77		Compulsory education the same for everybody in 9 years	
Compulsory education ended	1969-71	1974-77	1980-82
Education at secondary level	Possible if not received matriculation exam		
		Choice between vocational education or matriculation exam	
Education at tertiary level	If received matriculation exam and was admitted to an university Education at higher vocational level expanded during the period		
Study loans introduced in 1969	No effect on educational choice	Possible effect on educational choice	Effected educational choice
Study grants introduced in 1972	No effect on educational choice	Possible effect on educational choice	Effected educational choice

In the development of the decomposition, Solon (2004) points out that the parents' role in the decision on investment in children's human capital can more or less be crowded out by the investments done by the public sector. This has happened during the studied time period. The educational decision of the oldest cohort depended to a large extent on the size of their parents' means, irrespective of the child's ability. The youngest cohort could base their decision more on their own ability, since the educational system was reorganized and higher education was made available for everyone. Therefore, the human capital investments in children have become more productive. – Those with abilities study, and not necessarily those whose parents are rich.[8] We can find similar arguments in Aghion et al. (1999), where they argue that redistribution of income from rich to those who are poor increases growth in society. Those who are poorly endowed with human capital, have high returns to educational investments. Increasing educational investments among poorly endowed therefore favor growth in the society.

The educational reform also implies that the public investments in children's human capital have become more progressive. More progressive in the sense that children from poor or low-income families benefit more from public investments in human capital compared to children from high income families. Before the educational reform, children from poor or low-income families were credit constrained in their educational decision. After the reform and the expansion of higher education, children from poor or low-income families have possibilities to chose higher education.

The arguments in this section are summed up in Table 7. The conclusions from this reasoning are that human capital investments in children (θ) have become more productive and public investments in children's human capital (γ) have become more progressive during the period studied. The first increases while the second decreases the intergenerational correlation.

5 Concluding Remarks

The estimated intergenerational correlation in individual earnings are somewhat lower for pairs of daughters-parents than for sons-parents when parental or father's earnings are used as the indepen-

[8] Since human capital endowment is influenced by both nature and nurture, I assume that poor or low-income parents might get children with high capacity to learn – perhaps to a less extent than high-income parents. The opposite also holds, high-income parents might get children with low capacity to learn. If the capacity to learn or abilities influence the child's educational choise after the educational reform instead of parents' income as before, the human capital investments in children have become more productive.

dent variable. This relationship changes when equivalent family earnings are used as the earnings measure. The correlations in equivalent family earnings are higher, and at the same level for both daughters-parents and sons-parents. Elasticity estimates are similar for sons and daughters, and higher when family earnings are used instead of individual earnings. This implies that the choices of partner and stage of life are important factors in determining the economic status of these young men and women. Individual earnings reflects the individual's position on the labor market, while family earnings better reflects the economic status of the individual.

When testing for trends in the intergenerational elasticities, a positive trend for these young men and women was found when family earnings and in some cases when mothers' earnings are used as the independent variable. The decomposition of the correlation show the mechanisms behind the correlation. The different components, I argue, have changed somewhat during the studied time period in Finland.

There is an indication of an increase in the heritability of income generating traits during the studied period. When the educational level is used as a proxy for human capital, earnings return to human capital has increased, at least for men. These findings should increase the earnings correlation. Two counteracting mechanisms can be found. Public investments in children's human capital have become more progressive. This findings should reduce the earnings correlation. At the same time human capital investment in children has become more productive during the time period studied, which should increase the earnings correlation.

The changes in the public sector and in the educational system did not necessarily have that large effects on the intergenerational earnings correlation due to two counteracting mechanisms. The expected increase in the earnings correlation due to the increase in productivity of children's human capital was counteracted by the increasing progressivity in public investments. During the time period studied, children have had the possibility to build up their human capital by means of the investments by the public sector. But at the same time, the children's own ability has become more important when deciding upon their level of education, instead of relying on their parents economic situation.

This effect seems to apply particularly for children from families with low earnings. In Österbacka (2001), intergenerational earnings elasticities are conditioned on parental earnings quintiles. Children whose parents are in the lowest earnings quintile have low intergenerational elasticity in

earnings, while children whose parents are richer have higher earnings elasticities. Let us put this in relation to the parameter γ, that shows how progressive public investments in children are. The magnitude of the progressivity does not imply anything about the absolute values of public investments, only that the ratio of public investments to parental after-tax income increases when parental income decreases. Assume that a certain level of investments in a child's human capital has to be offered in order to actually increase the level of the child's human capital. If that critical level of investment is exceeded by the public investments, particularly children from families with low earnings benefit. If progressive taxes are included in the model, this effect would be even greater.

All estimates are done for the means, and there might be different effects at the ends of the income distribution. Further studies in this area would probably give more insight into the mechanisms behind the intergenerational correlation.

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