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ESPEN BRATBERG, ØIVIND ANTI NILSEN AND KJELL VAAGE

INTERGENERATIONAL MOBILITY: TRENDS ACROSS THE EARNINGS DISTRIBUTION

Department of Economics
UNIVERSITY OF BERGEN

Intergenerational Mobility:
Trends Across the Earnings Distribution*

by

Espen Bratberg[a]
(University of Bergen)

Øivind Anti Nilsen[b]
(Norwegian School of Economics and Business Administration, and IZA)

Kjell Vaage[c]
(University of Bergen)

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Abstract

The analysis, based on register data for Norwegian cohorts born 1950, 1955, and 1960, shows that the intergenerational earnings mobility is high. Using quantile regression, mobility is found to be lower at the lower end of the earnings distribution than at the upper end. The findings also indicate that mobility increases over time and that the increase seems to be somewhat higher for lower earnings. Finally, we find that the increase in earnings mobility over time has been larger for women than for men.

JEL codes: J62, C23

Keywords: Intergenerational mobility, time trends, quantile regression

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[a] Department of Economics, University of Bergen, Herman Fossgt. 6, NO-5007 Bergen, Norway. E-mail: espen.bratberg@econ.uib.no
[b] (Corresponding author) Department of Economics, Norwegian School of Economics and Business Administration, Hellevn. 30, NO-5045 Bergen, Norway. E-mail: oivind.nilsen@nhh.no, Phone: +47 55 959 281, Fax: +47 55 959 543.
[c] Department of Economics, University of Bergen, Herman Fossgt. 6, NO-5007 Bergen, Norway. E-mail: kjell.vaage@econ.uib.no

1. Introduction

Since the 1990s, there has been a growing body of research on intergenerational earnings mobility, see Solon (1999) for a recent review. The research reveals that the Scandinavian countries are characterised by relatively high intergenerational mobility relative to the US and the UK.[1] It has been suggested that the high mobility in the Scandinavian societies is the results of a policy aiming at equality of opportunity in cross-sectional, intra-generational sense. Norway, together with Sweden and Finland, is at the top of orderings of disposable income (Atkinson et al. (1995)). Several authors have suggested that the relatively low cross-sectional income inequality in Scandinavia is associated with higher intergenerational mobility. There are several explanations for the income equality. A cornerstone in the welfare state is the high degree of redistribution, with high taxes and public expenditure. This has also led to a higher share of employment in the public sector, a sector with less wage dispersion. Furthermore, family-friendly policies and generous child support together with a rather good supply of day-care for children are closely related to a high labour force participation rate among women. Another possible explanation for the equality in earnings in the Scandinavian countries is the relatively high level of union density and union coverage (see Wallerstein et al. (1997)). Moreover, Norway has a relatively centralised wage setting. As discussed by Kahn (1998), the decentralisation most OECD countries experienced in the 1980s and 1990s did not take place in Norway. On the contrary, the wage bargainings were recentralised and wage inequality became less in the late 1980s and early 1990s, leading to relatively stable earnings distribution, and has even become more compressed at the bottom, at least for part of the period.

[1] While Solon (1999) suggests 0.4 or a bit higher as a "reasonable guess" of the intergenerational earnings elasticity for men in the US, the similar parameter is close to 0.2 in Finland (Österbacka (2001)), Sweden (Gustafson (1994), Björklund and Jäntti (1997), Österberg (2000)), and Norway (Bratberg et al. (2004)).

Some few authors have investigated the association between intragenerational inequality and intergenerational mobility by studying trends over time. Blanden et al. (2004) in the UK, and Chadwick (2002) in the US both report decreasing intergenerational mobility during the previous two or three decades and explain this with the increase in the intra-generational inequalities in the respective countries. Bratberg et al. (2004) test for trends in the intergenerational mobility in Norway and find, in accordance with the UK and the US results, that the stable earnings distribution in Norway is associated with stability in the generational mobility. In addition, they suggest that the series of educational reforms, with equality of opportunity as a central aim, also have contributed to stability, or even an increase, in mobility.[2]

The bulk of the research referred hitherto has estimated the average transmission of earning across generations, basically by applying OLS (or IV) in the regression of son's earnings on the conditional mean of the father's earning. Implicitly one then assumes that the effects of the explanatory variables are identical over the entire distribution of the dependent variable. The purpose of this paper is to explore whether there are different degrees of mobility in different parts of the earnings distribution in Norway. For this purpose we use quantile regression (see Eide and Showalter (1999) and Grawe (2004) for recent applications).

Non-linearities in intergenerational earnings regression are often explained by credit constraints (Becker and Tomes, 1986, Becker, 1989). Low-earnings parents are constrained in the possibility to finance the education of their children; hence, their earnings fall below the earnings of non-constrained children with the same ability, resulting in concave (or S-shaped) earnings regression. Corak and Heisz (1999) as well as Grawe (2004) both find non-linearities in the earnings mobility across generations in Canada, notably that the mobility is

[2] Also Blanden et al. (2004) discuss the role of the education system in the determination of mobility trend, and suggest that the educational upgrading of the UK population for the most part occurred for people from the richer parents, and that this fact has reinforced the decrease in mobility generated by increasing income inequalities.

significantly smaller in the lower percentiles of the sons' earnings. Corak and Heisz claim that this is consistent with the borrowing constraints model, while Grawe (2004) claims that low mobility for the low-earners is at odds with the simple credit constraints hypothesis. In his interpretation, credit constraints should generate strongest persistence in the highest quantiles of the sons' earnings distribution.[3] For high-earning sons from low-earning families, the group that is most likely to be constrained, the mobility is remarkably high. This, he argues, most likely has to do with the educational system. In Canada, the post-secondary education is financed by the public sector. Hence, education is a field where very few children face binding credit constraints.

As in Canada, the education in Norway is publicly financed. There are no fees for students attending colleges and universities. Furthermore, the State Educational Loan Fund (SELF) provides grants and loans to pupils in upper secondary schools, and to university and college students. There has been a steady increase in the number of students benefiting from grants and loans from SELF since it was founded in 1947, and today most Norwegian students finance their studies through grants and loans from SELF. Also several school reforms during the last four decades have contributed to increased educational attainment. A central aim has been to enhance equality of opportunity along the socioeconomic dimension. Aakvik et al. (2003) provide empirical evidence that there has been a particularly steep increase in attainment among the disadvantaged groups that where the main target of the educational reforms. The younger the cohorts in our sample, the more they have benefited from the reforms.

At our disposal for modelling of the intergenerational earnings mobility we have earnings data for the cohorts (males and females) born 1950, 1955, and 1960, where earnings until the age of 35 are available, together with series of annual earnings for fathers of the

[3] The reason is that this is where we find the highest share of sons with high ability, for whom the losses from being constrained with respect to (the optimal amount of) education is largest.

respective cohorts. Hence, we are able to evaluate trends in the earnings regression, in addition to the more frequently reported levels. According to Grawe (2004), one should expect relatively few cases of credit constraints if the publicly financed education-argument carries over from Canada to Norway. Hence, we expect relatively high mobility for high-earning children and high persistence for the lowest quantiles. Moreover, we expect this tendency to be reinforced for the younger compared to the older cohorts, as credit constraints in educational investments diminished over the cohorts in question.

The remainder of the paper is organised as follows. Section 2 presents the data, institutional background and discusses the methods. Section 3 brings the results from the quantile regressions, while Section 4 offers some concluding remarks.

2. Data, Institutional Background, and Methods

2.1 Data

Our data source is the Norwegian Database of Generations (DBG). As the name suggests, the purpose of this full population database is to link information on individuals to information on their parents. The DBG includes the cohorts born every fifth year in the period 1950-1995. The linking of parents and children is based on the Central Person Register, which includes all Norwegian residents with person identity numbers. The linking started with the 1970 Census which recorded all children living in the parental home at that time. Therefore, the match is poorer for the 1950 cohort, 20 years of age in 1970, giving fewer observations for this first cohort relative to later cohorts. Furthermore, the tendency to leave the parental home before the age of 20 in 1970 was larger for young women than men, thus there are fewer women than men for the 1950 cohort.[4] Important for our purposes, the data includes full series of yearly earnings 1967-1995, based on mandatory tax reports.[5] The data also includes other individual

[4] For a more detailed discussion of the data, see Bratberg et al. (2004).
[5] Unemployment benefits and sick pay are included, but not means-tested benefits.

and family information, obtained mainly from censuses. We include children of both gender, but use only fathers' earnings as indicators of the family's earnings capacity.

The idea behind estimating parent-child income associations is that the parent's lifetime earnings capacity may be transferred to the child by some economic mechanism, typically investment in education. Thus it is important to have the best possible measure of lifetime earnings, and the most usual approach is to use averages over several years to reduce the errors in variables bias which follows from using single years of parents' earnings, see e.g. Solon (1992). We follow that approach. It is also well known that earnings at young ages may be poor indicators of lifetime earnings. We have therefore selected the cohorts born 1950, 1955, and 1960, where earnings until the age of 35 are available. Furthermore, as the earnings series begins in 1967, we have constrained the sample to individuals with fathers younger than 40 at birth of the child - someone aged 40 in 1950 would be 57 in 1967. Only earnings until the age of 65 are used.

We use five-year average earnings 1967-71, 1972-76 and 1977-81 for fathers of the 1950, 1955, and 1960 cohorts, respectively. For their children, we use five-year averages at age 31 - 35. Thus their incomes are measured 1981-85, 1986-1990, and 1991-95. Earnings are measured in logs, and the averages are over log earnings (i.e., not log of average earnings). Years with zero income are excluded. Fathers' earnings are "age adjusted" by regressing income on age and age squared and using the residual from that regression (including the constant term) as the income measure. As there is no age variation within each cohort of children, no such adjustment is performed for them.

2.2 Descriptive Statistics and Institutional Background

We start our analysis by looking at some descriptive statistics.

(Table 1 about here)

In Table 1 we report the log earnings and for both men and women and their fathers. For men we see that the log earnings are rather stable over time. For women the income is increasing over time. This could be caused by several factors. The labour force participation rate of women has increased over time. At the same time there has been a trend that more and more women work full time. These patterns may be affected by the fact that the average educational level for women has increased over time.[6] This increased educational level will of course affect their labour supply and the wage they actually get. Looking at the distribution of the earnings at age 35 (measured in 1995 NOK), we see that for men the median and the 90 percentile are growing steadily over time (2-6% over a five years period). The 10 percentile has a slump for the 1955 cohort (35 years in 1990). This is probably caused by the fact the Norwegian economy experienced a recession in the late eighties and early nineties.[7] Thus, it may indicate that those who are most affected are those with the lowest paid jobs. The inequality or compression of the income distribution is more easily seen when we look at the ratios of the percentiles. For the 1955 cohort and the 1960 cohort of men all the percentile ratios are rather stable. From 1950 until 1955 the percentile ratios indicate more a higher spread in the incomes. Turning to women, we see a huge earnings gap relative to men. All the reported percentiles are lower for women than the corresponding percentiles for men. We see however that the increase in earnings is much steeper for women than for men. This is consistent with the aggregate picture of higher labour supply of women over time discussed above. But, even with a significant growth in the earnings, we see an overall earnings compression. It is also worth mention that the when we do not find that the lowest percentile shows a slump for the 1955 cohort of women, while this was evident for men, this is consistent with a pattern of a rather segregated labour market for men and women in Norway,

[6] Table A1 shows some aggregate numbers for the Norwegian population. We see that the share of women with education 13 years or more has increased from 10.3 percent in 1980 to 19.3 in 1995. Evidently the increase among the younger cohorts will be more significant.

[7] See Torp (1996) for a survey of the Norwegian labour market situation in the late eighties and early nineties.

where women are working in public sector while men are overrepresented in manufacturing and construction. These latter sectors were the ones which really experienced the recession in the late eighties and early nineties.

2.3 Estimation method

The intergenerational earnings or income mobility is typically formulated as the association between parents' economic status and the status of a child given by the following reduced form model

$$y_i^c = \alpha + \beta \cdot y_i^p + \varepsilon_i$$

where superscripts c and p denote "child" and "parent", respectively, y is a measure of "lifetime"or "permanent" income in logs, β is the slope coefficient, and ε is a random error term. The closer to zero β is, the higher is intergenerational mobility. This reduced form formulation may be motivated by utility-maximising families investing a part of parents' earnings in the human capital of children, cf. Becker and Tomes (1979, 1986), Solon (1999). When one estimates the above given equation by OLS, the effect of explanatory variables are measured on the conditional mean of the dependent variable. Thus, one implicitly assumes that the effects of the explanatory variables are identical over the entire distribution of the dependent variable. As noted in the introduction, there are no a priori reasons to believe that the intergenerational transmission of economic resources is the same in all parts of the income distribution. Quantile regression is well suited to explore this notion since it is a technique for estimating the effect of explanatory variables at different points in the distribution of the dependent variable, which in our case are individual log wage measures. Whereas OLS estimates the conditional mean, quantile regression regression estimates quantiles conditional

on explanatory variables. Thus estimating several quantiles makes it possible to explore the shape of the conditional distribution, not just its mean. As described by Koenker and Bassett (1978) or Buchinsky (1998), the coefficient vector β is estimated as the solution to

$$\min_{\beta(\theta)}\left\{\sum_{i:y_i\geq x_i\beta(\theta)}\theta\left|y_i-x_i\beta(\theta)\right|+\sum_{i:y_i<x_i\beta(\theta}(1-\theta)\left|y_i-x_i\beta(\theta)\right|\right\}$$

where y_i is the dependent variable, x_i is a vector of explanatory variables, β is the coefficient vector, and θ is the quantile being estimated. In contrast to OLS, quantile regression measures the effect of the explanatory variables on the θth quantile of the dependent variable. Thus the coefficient vector β will differ depending on the particular quantile being estimated.

3. Quantile Regression Results

Table 2 and Figures 1 and 2 present the quantile regression results, where we have regressed childen's earnings on father's earnings, age and age squared.

(Table 2, Figure 1 and Figure 2 about here)

The earnings of the children are measured by using an average of their log earning at age 31-35. The OLS results are included for ease of comparison. For elaboration and comparison with other studies, see Bratberg et al. (2004). Turning to the quantile regression results, the overall picture is that the estimated coefficients are higher for the lower percentiles than for the higher ones. This means that the intergenerational mobility is lower at the lower end of the earnings distribution than at the upper end, for sons as well as for daughters[8]. The findings of highest elasticities between fathers and their offspring among those located in the lowest part

[8] There are only two significant exceptions to this monotonicity: the 25 percentile coefficients for women in the 1950 and 1960 cohorts are higher than the respective 10 percentile coefficients.

of the earnings distribution are in line with the findings of Corak and Heisz (1999), Eide and Showalter (1999), and Grawe (2004).

Continuing to the comparison across cohorts, the overall trend appears to be a decrease in the estimated coefficients, i.e. an increase in the intergenerational mobility. The increased mobility is not homogeneous across earnings distribution and across gender, however. First, the strongest increase has taken place in the lower percentiles. As such one may say that policies that have been enforced to reduce the importance of family background for an individual's economic failure or success have been successful: Not only has the mobility increased within almost every percentile, but the strongest growth across cohorts has been among the low-earners. Second, this pattern is reinforced for daughters compared to sons, at least if we compare the 50 cohort on the one hand to the 55 and 60 on the other (the differences between the 55 and 60 cohorts are generally small.[9] For example, the father-daughter earnings elasticity is almost twice as high and, hence, the mobility almost half of the size for the 5th percentile compared to the median of the distribution. The difference between the 1950 and an average of the 1955 and 1960 cohorts is about the same in magnitude: The daughters' dependence on their fathers' earnings has decreased by approximately 50%.[10]

It is reasonable to attribute the gender differences in mobility to (changes in) the labour force participation and educational attainment during the previous decades. Even though it is beyond the scope of the present paper to bring formal tests of this hypothesis, the aggregate statistics reported in Table A1 might shed some light on processes behind the reported mobility parameters. A striking feature of the table is the development in the labour

[9] Some care should be taken, since the initial child-parent linking in 1970 may induce sample selection problems. These problems might be more significant for women relative to men.

[10] Couch and Lillard (1998) and Corak and Heisz (1999) show that the estimated intergenerational mobility is sensitive to the selection rule used and find that when low or zero earnings observations are excluded the results reveal less mobility. To assess the robustness of our results, we have employed various exclusion criteria of the lowest earnings, both for the fathers and the children. In line with the studies op. cit. we find mobility to become somewhat smaller when the inclusion criteria become stricter. Furthermore, we find that the sensitivity to the cut-off criteria to be largest in the lowest part of the distribution. Thus, the differences over the income distribution become less. The result that the change in mobility is largest for the lower quantiles seems to remain.

force participation for women. While the share of females participating in the labour force in 1980 was about 62%, it has increased to almost 75% in 1995. Furthermore, the bottom rows of Table A1 show that the educational attainment has increased for both genders, but even more for women compared to men. We find it reasonable that increased educational attainment and increased participation in the labour market increases the economic opportunities and reduces the daughters' dependence on the fathers' earnings. Combined with the fact that the increase in the educational attainment has been particularly steep in the low-earning families (Aakvik et al., 2003), the highest increase in mobility is to be expected in the lowest earnings percentiles. A related phenomenon is found in Black et al. (2004). Using Norwegian data, they investigate the correlation between parents' and children's education. When they use the reform of the education system that was implemented in the 1960s as an instrument for parental education, they find little evidence of a causal relationship in parent-child education. This lack of correlation in education is consistent with the appearing lack of earnings correlation in our study.

4. Concluding remarks

Norway is characterised as a country with high income equality and a well developed welfare state. One interpretation of the modern welfare state is that it attempts to reduce the importance of family background. In this paper we have examined variation in the parent-child mobility across the earnings distribution in Norway. The mobility is found to be high and in line with findings in other Scandinavian countries. When we analyse variations across the earnings distribution, we find the mobility to be lower at the lower end of the earnings distribution of the offspring than at the upper end. The empirical findings also indicate that mobility increases over time and that the increase seems to be somewhat higher for lower

earnings. The latter findings are consistent with *a priori* expectations given the policy designed to enforce equality of opportunities, with school reforms and increased grants and loans as instruments to increase educational attainment. As such one may say that policies that have been implemented to reduce the importance of family background for individuals' economic failure or success apparently have been successful. Finally, we find that the increase in earnings mobility over time has been larger for women than for men, which is in accordance with the increased education and labour force participation among women.

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Table 1: Descriptive statistics

	Men			Women		
	1950-cohort	1955-cohort	1960-cohort	1950-cohort	1955-cohort	1960-cohort
Log earnings at 35	12.26	12.27	12.28	11.36	11.53	11.67
Avg. Log earnings age 31-35	12.18	12.20	12.15	11.04	11.28	11.45
Father's 5-year log earnings average	11.95	12.08	12.20	12.03	12.06	12.20
Father's age	48.17	47.68	47.20	48.25	47.68	47.14
P10 earnings at 35	128.93	117.07	121.00	20.25	32.39	39.40
P50 earnings at 35	226.05	231.21	238.70	116.76	135.17	154.60
P90 earnings at 35	359.86	380.22	392.40	222.70	227.16	245.50
P90/P10 earnings at 35	2.79	3.25	3.24	11.00	7.01	6.23
P90/P50 earnings at 35	1.59	1.64	1.64	1.91	1.68	1.59
P50/P10 earnings at 35	1.75	1.98	1.97	5.77	4.17	3.92

Note: Fathers' real earnings (1995 NOK) are averaged over 1967-71, 1972-76, 1977-81(1950 cohort, 1955-cohort, and 1960 cohort respectively)
Fathers' age in 1967/72/77

Table 2: Intergenerational earnings mobility estimates, Quantile regressions

	5th	10th	25th	50th	75th	90th	95th	OLS	Nbr. of obs.
Men									
1950-cohort	0.396	0.313	0.187	0.135	0.117	0.115	0.108	0.155	18956
	(0.037)	(0.022)	(0.006)	(0.004)	(0.007)	(0.01)	(0.017)	(0.008)	
1955-cohort	0.279	0.237	0.170	0.114	0.106	0.104	0.099	0.138	23378
	(0.036)	(0.019)	(0.005)	(0.004)	(0.005)	(0.008)	(0.011)	(0.006)	
1960-cohort	0.322	0.224	0.166	0.104	0.087	0.094	0.094	0.129	23892
	(0.038)	(0.023)	(0.007)	(0.004)	(0.005)	(0.009)	(0.012)	(0.007)	
Women									
1950-cohort	0.380	0.341	0.385	0.228	0.166	0.115	0.115	0.221	9421
	(0.078)	(0.057)	(0.043)	(0.025)	(0.017)	(0.012)	(0.018)	(0.023)	
1955-cohort	0.179	0.139	0.190	0.132	0.089	0.073	0.070	0.119	21238
	(0.05)	(0.03)	(0.019)	(0.009)	(0.007)	(0.006)	(0.009)	(0.01)	
1960-cohort	0.264	0.257	0.201	0.116	0.080	0.067	0.069	0.126	22050
	(0.041)	(0.03)	(0.015)	(0.009)	(0.006)	(0.007)	(0.015)	(0.01)	

Note: The income of men and women are measured as average of their log earnings at age 31-35 (1981-85, 1986-90, and 1991-95 respectively).
Fathers' earnings measures; 5-year averages, 1967-71, 1972-76, 1977-81.
Results are adjusted for fathers' age by including their age and age-squared as regressors in the regression models.

Figure 1: Quantile regression estimates: men (based on Table 2)

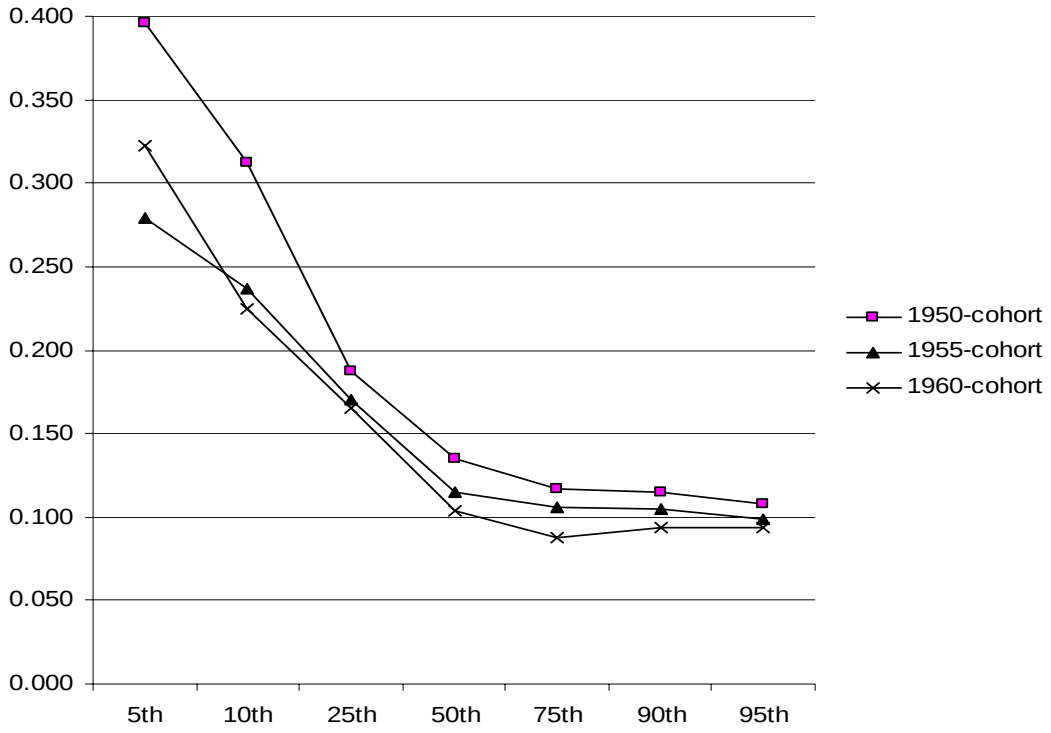

Figure 2: Quantile regression estimates: women (based on Table 2)

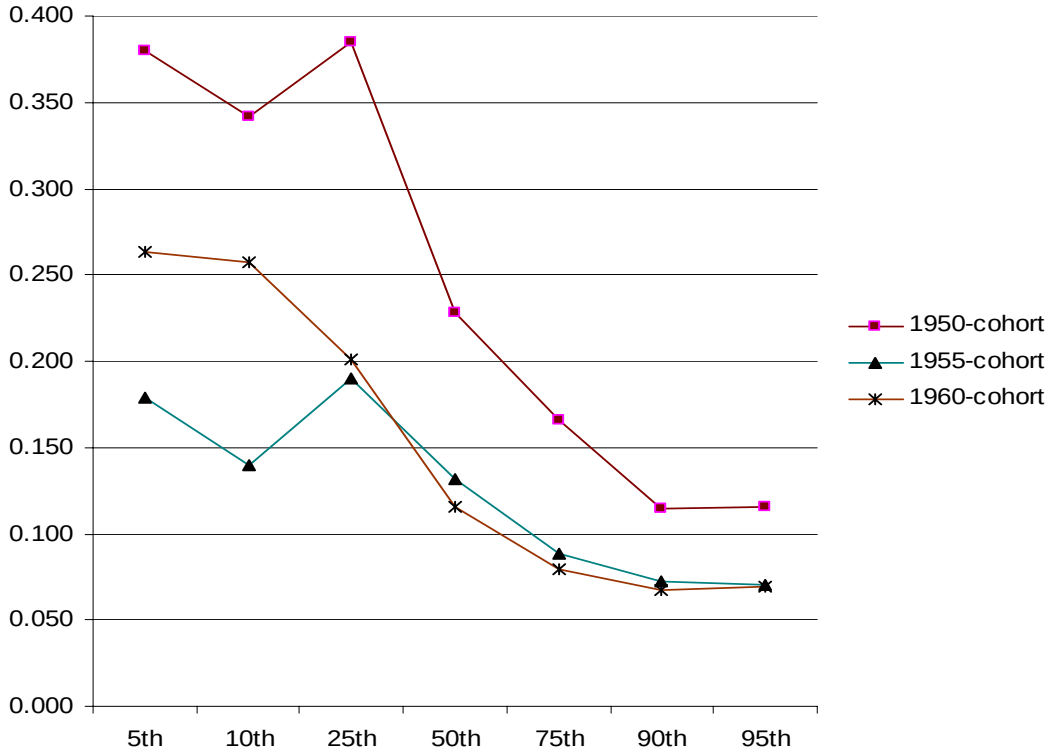

Table A1: Aggregate statistics; labour force participation and educational level

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Share of population in the labour force																
Men 25-66 years old	90.1	90.0	90.1	89.3	89.6	89.6	89.1	89.1	88.6	88.2	87.0	86.4	86.2	85.7	85.7	86.6
Women 25-66 years old	62.2	64.3	64.8	65.8	67.1	68.5	71.0	72.6	72.7	72.0	72.6	72.8	73.0	73.3	73.6	74.7
Share of employed working part time																
Men	9.8	10.7	11.1	11.6	11.5	10.6	10.4	11.2	..	8.4	8.8	9.2	9.8	9.8	9.5	9.4
Women	52.5	54.1	54.3	54.8	53.6	52.6	52.1	50.7	..	48.9	48.2	47.6	47.1	47.6	46.5	46.7
Weekly hours worked																
Men	41.1	41.0	41.1	40.8	41.0	41.5	41.9	41.0	41.6	41.2	40.6	40.3	40.0	40.0	40.0	39.8
Women	29.2	28.6	28.7	28.5	28.9	29.3	29.3	29.3	30.1	30.2	30.1	30.0	30.0	30.2	30.3	30.3
Unemploymenst (LFS)																
Men 16-74 years old	1.3	1.5	2.3	3.2	3.1	2.2	1.5	1.7	3.0	5.1	5.6	5.9	6.5	6.6	6.0	5.2
Women 16-74 years old	2.3	2.7	3.0	3.8	3.2	3.1	2.5	2.5	3.4	4.7	4.8	5.0	5.1	5.2	4.7	4.6
Education (for 16 years old or older)																
Men																
9 years or less	40.5	..	..	..	..	35.1	34.0	33.3	32.3	31.0	29.9	28.8	27.8	26.5	25.6	23.9
10-12 years	45.1					49.1	49.9	50.4	51.1	51.5	52.1	52.7	53.1	53.5	53.8	55.0
13 years or more	14.4	..	..	..	..	15.8	16.1	16.3	16.6	17.5	18.0	18.5	19.1	20.0	20.6	21.1
Women																
9 years or less	47.1	..	..	..	..	41.7	40.6	39.8	38.8	37.3	36.1	35.0	33.9	32.7	31.6	29.8
10-12 years	42.6					46.0	46.7	47.1	47.6	48.2	48.7	49.0	49.4	49.7	49.9	50.9
13 years or more	10.3	..	..	..	..	12.3	12.7	13.1	13.6	14.5	15.2	16.0	16.7	17.6	18.5	19.3

Source: Statistics Norway

Department of Economics
University of Bergen
Fosswinckels gate 6
N-5007 Bergen, Norway
Phone: +47 55 58 92 00
Telefax: +47 55 58 92 10
http://www.svf.uib.no/econ