Sibling correlations in terms of education, profession and earnings, in France

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Abstract

This paper analyses intergenerational transmission of inequalities in France, estimating sibling correlations in terms of education, profession and earnings. Data from the French Education-Training-Employment (FQP) survey are used to investigate similarities between siblings. Sibling correlations around 0.3 and 0.5 are respectively found for education years and prestige scores. In terms of annual earnings, estimations lie in between, around 0.4. Evolution in time and effect of particular familial characteristics are also further investigated.

1 Introduction

The extent of intergenerational transmission of socioeconomic status has interested economists for decades, as it reflects the level of equality of opportunities inside a society. The degree to which socioeconomic status is transmitted from one generation to the next indeed captures the impact family background can have on children's success in later life: the effect of factors independent from children's choices, talents and efforts on their future success. In other words, it represents to what extent childhood circumstances are reflected in adult life.

As a measure of the degree of intergenerational mobility, empirical studies have often analyzed the intergenerational elasticity, the regression coefficient relating child's outcome to parental one. However the impact of the familial environment can not be restricted to a single parental characteristic. Sibling correlations thus provide a summary measure of all effects attributed to factors shared by siblings. It captures the overall impact of growing up in the same family, including for instance sharing a common neighborhood.

Sibling correlations for various socioeconomic outcomes have been estimated in different countries. A summary of some recent studies' results is reported in Table 13, in appendix,

and comparable litterature reviews can be found in Björklund and Jäntti (2009), Björklund and Salvanes (2010) and Björklund and Jäntti (2012). In terms of education, sibling correlations from 0.4 for Nordic countries and 0.6 for the United States are found. They amount around 0.2 for Nordic countries and 0.4 for Germany and the United States, in terms of income. Nevertheless, if several authors have investigated the cases of these countries, there is currently no work studying intergenerational transmission of socioeconomic status using sibling correlations, in France. And this is the gap in the litterature we want to fill with this paper.

We use data from the French Education-Training-Employment (FQP) survey to estimate sibling similarities in different socioeconomic outcomes: profession, education and earnings. And we find sibling correlations around 0.3, 0.4 and 0.5 for education years, annual earnings and prestige scores respectively. When conducting a study by gender, it appears that same-sex siblings have more in common than in mixed pairs, for each outcome. Additional parameters are then investigated, not leading to any clear conclusion toward the evolution in time of sibling correlations. However concerning the impact of familial composition, closely spaced siblings are more alike and family size seems to have a positive effect on sibling correlations. Finally we investigate the effect of parental education and profession but observe no clear pattern, except for the decrease of sibling correlations in earnings with educational levels of both parents.

The paper proceeds as follows. Section 2 presents the FQP data. Section 3 describes the prediction of the three outcomes we further investigate. Section 4 presents the estimation method of sibling correlations. Section 5 reports the results and Section 6 concludes.

2 Data

The data used in this paper come from the French Education-Training-Employment (FQP) survey. The targeted individuals are 18 to 65 year old people living in France, yielding a sample of around 40000 individuals. We use the wave of 2003, in which information on a randomly selected sibling is available. The wave of 1993 is also used in order to help predicting years of education and prestige scores for both siblings. Additionally waves of 1970, 1977 and 1985 are used to predict earnings.

For our analysis we select individuals born between 1943 and 1973, which means 30 to 60 years old in 2003. We only keep individuals paired to a sibling. We allow up to 10 years of age difference between the individual (referred to as "ego") and his/her sibling (referred to

as "alter"). Therefore, siblings can be born between 1933 and 1983 and are 20 to 70 years old in 2003. This choice is made to avoid sampling young people with only older siblings, and old people with only younger siblings.

Available information concerning gender, birth cohort, education and socio-professional category for both siblings allows us to investigate sibling correlations in different socio-economic outcomes. Additional information on the composition of the family - as number and birth order of brothers/sisters, age difference between ego and alter - and birth cohort, education, profession of the parents, enable taking various characteristics of the family into account to investigate their impact on sibling correlations.

Descriptive statistics

First, gender repartition and ages among siblings are reported in Tables 1 and 2 respectively. The sample counts 21885 pairs of siblings, 5240 of which being pairs of brothers and 5507 pairs of sisters. The remaining 11138 are mixed pairs. Siblings are aged 44 on average, with an average age difference of 4 years.

Table 1: Descriptive statistics - gender

	sex alter		
sex ego	0	1	Total
0	5240	5054	10294
1	6084	5507	11591
Total	11324	10561	21885

Table 2: Descriptive statistics - age

Variable	Mean	Std. Dev.	Min	Max
age ego	44.265	8.677	30	60
age alter	44.227	9.804	20	70
age diff.	4.276	2.581	0	10

Note: 21885 observations

In Table 3 is reported the repartition of certificates and degrees obtained respectively by ego and alter. From the bottom to the top, the first category contains people without any certificate. Then *CEP* corresponds to a former school leaving certificate, taken at the end

of primary education. *BEPC* is the French equivalent of the Junior High school certificate. *CAP* and *BEP* are vocational training certificates taken at secondary school and at about 18 respectively. *Baccalauréat technologique* or *professionnel* and *brevet professionnel* correspond to vocational high school and apprenticeship diplomas. *Baccalauréat général* is the French equivalent of the A-levels/high school diploma. *BTS*, *DUT* and *baccalauréat+3* refer to vocational training or technical certificates taken at end of 2-year higher education course, and a 3-year university degree, respectively. Finally, *diplome d'ingénieur, de grande école* and *baccalauréat+5* or more correspond to degrees from engineering or business prestige university-level colleges, or masters and PhD.

Table 3: Descriptive statistics - degrees

	ego		alter	
Degree	Freq.	Percent	Freq.	Percent
dipl. d'ing./gde école/bac+5 et +	2383	10.98	2581	11.87
BTS/DUT/bac+3	2009	9.26	2506	11.53
bac général	1409	6.49	1936	8.90
bac techno/pro / brevet pro	1652	7.61	970	4.46
CAP/BEP	5857	27.00	6715	30.88
BEPC	2080	9.59	1705	7.84
CEP	1892	8.72	1842	8.47
Aucun	4414	20.34	3487	16.04
Total	21696	100.00	21742	100.00

Then are reported in Table 4 the socio-professional categories of both populations (ego and alter). Here is presented a basic classification counting 7 groups: unknown; farmer; skilled workman, craftsperson, storekeeper, company manager; executive, manager, intellectual worker; intermediate occupations; administrative, sales or service occupations; and laborer. A more detailed classification containing 31 groups is also available in the data and used in this paper. For levels of education as well as for socio-professional categories, the distributions for ego and alter are close.

Table 4: Descriptive statistics - socio-professional categories

	ego		alter	
Category	Freq.	Percent	Freq.	Percent
unknown	16	0.07	237	1.17
farmer	580	2.71	574	2.83
skilled workman, craftsperson, storekeeper, company manager	1125	5.25	1513	7.45
executive, manager, intellectual worker	2965	13.84	2020	9.95
intermediate occupations	5048	23.56	4507	22.20
administrative, sales or service occupations	6633	30.96	6139	30.24
laborer	5055	23.60	5308	26.15
Total	21422	100.00	20298	100.00

3 Prediction of socioeconomic outcomes for both siblings

Continuous variables are constructed, representing years of education and prestige scores, in order to estimate sibling correlations in terms of education and profession. The predictions of these outcomes use information available for both siblings and are respectively based on OLS regressions and scales of prestige scores. Then earning profiles are estimated to predict annual earnings for both siblings using information on education and occupation. OLS regressions as well as Heckman models are computed, to assess the issue of women's labour market participation.

3.1 Education years

In order to predict a continuous measure of education years, two methods are investigated. First is implemented an OLS regression including as explaining variables: gender, a quartic polynomial in birth year, dummies for the different possible degree categories, and all corresponding interactions. Waves of the survey of 1993 and 2003 are used in order to predict a number of education years for individuals born from 1933 to 1983 (people can only be up to 65 years old in 2003 with the wave of 2003, and we need siblings "alter" aged up to 70 in 2003, which is why we also need the wave of 1993). The graphic representation for this fourth order regression is reported Figures 1 and 2 for men and women respectivey, in appendix. The sibling correlation obtained using the fourth order polynomial function in birth cohort is 0.583.

Then a non-parametric specification including dummies for each gender/cohort/degree category is tested. The sibling correlation resulting from this specification is 0.578 and a graphic representation is reported in Figures 3 and 4, in appendix. Sibling correlations by gender for parametric and non-parametric specifications are reported in Table 16 in appendix. As expected, mixed sibling pairs share less than same-sex siblings, and sisters seem to have more in common than brothers. Also correlations obtained with the different specifications are very close.

3.2 Prestige score

Concerning prestige scores associated with the profession, two different strategies have also been implemented, based on Chambaz et al. (1998). In their paper, scales of prestige scores are constructed for different classifications of professions or socio-professional categories. First we choose to simply aggregate some of the groups from our classification in 30 categories (the first category being "unknown" and thus excluded) to fit their classification in 15 categories, and attribute the corresponding scores to each sibling, the socio-professional category being available for both. This first classification is presented in Table 14, in appendix.

Then we also want to obtain a more precise scale by attributing a score to each of our 30 groups. Therefore we use the extremely detailed scale of scores attributed to a list of professions. The profession is however only available for ego in our data, so that we attribute the weighted mean of the scores (weighted by the frequency of each profession in the groups) for each of our 30 groups of socio-professional categories, for both siblings. This second classification is reported in Table 15, in appendix.

The sibling correlations obtained for the classifications with 15 and 30 groups respectively are 0.335 and 0.330, so these two scales of prestige scores yield again very similar results. More detailed correlations by gender are presented in Table 16 in appendix. Again the correlations are higher for same-sex siblings, and also slightly higher for sisters than for brothers.

3.3 Women's labor force participation

The relatively low participation of women into the labor force can raise an issue. Indeed prestige scores are attributed according to the last observed socio-economic category. Mostly for women, this potentially reflects the professional situation in the beginning of a short career, stopped for instance to raise children. But our interest is in the correlations between obtainable prestige scores, potentially reached if everybody had always worked.

A first solution is to only take into account currently working women. Therefore, we observe the restricted sample of women (ego) with a brother (alter). The sibling correlations between all women or only employed women, and their brothers are reported in Table 5. They are presented for prestige scores (30 groups) as well as for education years (4th order), to compare the effects on an outcome potentially affected by the employment of women and the other not. We also compare these results to the same obtained for men (ego) with brothers (alter). For education years, we also reduce our sample to individuals for which it has been possible to construct a prestige score. As expected for education years the results are almost not modified by sampling only currently employed individuals as ego. But the differences are not significant either for prestige scores. And sampling according to the employment status appears to change the results only slightly more for women than for men.

Table 5: Sibling correlations - all/active women

	Prestige score		**Education years**	
	est.	*obs.*	est.	*obs.*
All	0.330	*19673*	0.580	*19589*
ego: woman ; alter: man	0.302	*5546*	0.549	*5525*
ego: active woman ; alter: man	0.294	*4437*	0.535	*4420*
ego: man ; alter: man	0.356	*4936*	0.584	*4901*
ego: active man ; alter: man	0.362	*4554*	0.582	*4527*

However a selection problem can rise if the sample is restrained to currently working women. Another method is the investigation of brother/brother-in-law correlations. Again based on the sample of women with a brother, we construct prestige scores for women's spouses (socio-professional categories being available for them too). And we compare them to brothers' ones. The results are reported in Table 6. Brother-in-law/brother correlations are not very different from, even if slightly lower than sister/brother correlations.

Table 6: Sibling correlations - brothers/brothers-in-law

	Prestige score	
	est.	*obs.*
All	0.330	*19673*
Sister/brother	0.302	*5546*
Brother-in-law/brother	0.288	*4306*

3.4 Annual earnings

There is a measure of annual earnings in the wave 2003 of the survey, however only available for interviewed individuals, not for their siblings. The strategy to obtain earnings for both siblings is here to estimate earning profiles in a first step with as much information as possible from all waves from 1970 to 2003 (1970, 1977, 1985, 1993 and 2003). Then in a second step log of earnings are predicted for both siblings in the database of 2003.

Earning profiles are estimated based on individuals born between years 1933 and 1983 and observed from ages 25 to 55. Age is normalized to zero at age 40, age at which earnings are predicted, in order to avoid lifecycle bias. Birth cohort is also normalized to zero in 1963 and as explanatory variables for the OLS regression are constructed five groups of birth cohort covering 10 years each (1933-1942, 1943-1952, 1953-1962, 1963-1972 and 1973-1983). The two last groups are actually used as only one in the estimation, because the last one contains individuals born from 1973, too late to predict a satisfactory earning profile, and stops in fact at year 1978, no individual being younger than 25.

The same dummies corresponding to the different possible degree categories used in the construction of a continuous measure of education are also here regressors in the prediction of earnings. For the occupation, the classification in 7 categories is used for interactions with cohort groups. However categories "unknown","farmer" and "skilled workman, craftsperson, storekeeper, company manager" are not kept, because most individuals of the two last ones are not employed and therefore do not present a satisfactory measure of earnings. A more detailed classification of socio-professional categories compatible with all waves of the survey is also used as principal effects. The four remaining categories of the previous classification contain here 17 categories (only the clerical occupations are additionally excluded).

For men, the regression equation of the log of earnings $y_{i,c,t}$ thus contains different age-earnings profiles based on education, as well as interactions between cohort groups and both education and occupation, and can be written:

$$y_{i,c,t} = \alpha_t + \phi(Z_{i,c}, c) + \psi(Z_{i,c}, age_{i,c,t}) + u_{i,c,t},$$

where i, c, t are indices for individual, birth cohort and date of the survey, $Z_{i,c}$ contains educational and occupational characteristics, ϕ captures the effect of these characteristics depending on the cohort and ψ is a quadratic function of age interacted with education.

Then predicted log of earnings at age 40 in 2003 for both siblings are computed by:

$$\hat{y}_{i,c,t} = \hat{\phi}(Z_{i,c}, c).$$

To predict earnings for women, the same OLS regression as well as alternatively the Heckman model are implemented, in order to handle the issue of their participation into the labor force. Number of children and spouse's education level, contained in $W_{i,c}$, are then additionally used to account for the probability of being active, with $y_{i,c,t}$ only observed for women when the following selection equation is satisfied:

$$f(Z_{i,c}, W_{i,c}) + v_{i,c,t} > 0.$$

To illustrate these earnings profiles, we represent earnings gains obtained for each level of education for the different birth cohort groups, as well as the effect of age on earnings also for each level of education and for the cohort group of reference, individuals born between 1953 and 1962. This is reported respectively in Figures 5 and 6 for men, and for women in Figures 7 and 8 when earnings are predicted by OLS regression and in Figures 9 and 10 when Heckman model is used.

The sibling correlations estimated with each model used for the prediction of women's earnings are 0.410 and 0.415. Again, there is no big difference between both specifications' results. More detailed estimates by gender are reported in Table 16 in appendix. Though correlations are again higher for same-sex pairs than for mixed pairs, here brothers seem to share a little more than sisters.

4 Estimation of sibling correlations

4.1 Polychoric correlations

First we use the discrete variables of highest completed degree and socioprofessional group to investigate the association between siblings' success. Polychoric correlation coefficients measure the association between two ordinal variables assumed to be determined by a latent continuous variable following a bivariate normal distribution. We thus use our classification of degrees in 8 groups (1 to 8 from higher degrees to no degree), and to get an ordinal variable for occupation, we gather farmers and laborers and obtain the following classification: 1) executive, manager, intellectual worker; 2) intermediate occupations; 3) skilled workman, craftsperson, storekeeper, company manager; 4) administrative, sales or service occupations and 5) farmers and laborers.

4.2 Pearson's correlations

Then in order to estimate sibling linear correlation coefficients, we model an outcome y, here education years, prestige scores or log of earnings, for individual j in family i:

$$y_{i,j} = a_i + b_{i,j},$$

where a_i is a component common to both siblings in family i and $b_{i,j}$ is an individual-specific component for sibling j in family i. These components are assumed to be independent of each other, so that the variance of $y_{i,j}$ can be written:

$$\sigma_y^2 = \sigma_a^2 + \sigma_b^2.$$

In this decomposition, σ_a^2 captures the variance between families, while σ_b^2 captures the variance within families. The sibling correlation ρ in which we are interested is the fraction of the overall variance of the outcome, due to shared background:

$$\rho = \frac{\sigma_a^2}{\sigma_a^2+\sigma_b^2}.$$

A set of complementary controls can be included in the estimation of the model in order to first purge the outcome of some effects:

$$y_{i,j} = X'_{i,j}\beta + a_i + b_{i,j} = X'_{i,j}\beta + e_{i,j}.$$

The vector $X_{i,j}$ here contains a gender dummy, a quartic function of birth cohort, and all corresponding interactions. And the residuals $e_{i,j}$ from the regression equation, free of gender and age effects, are then used in order to compute Pearson's correlations between two siblings 1 and 2:

$$\rho_{e_1,e_2} = \frac{cov(e_1,e_2)}{\sigma_{e_1}\sigma_{e_2}}.$$

Different sibling correlations are computed for same-sex (brother/brother and sister/sister) and mixed (brother/sister) sibling pairs. We also want to investigate the evolution of the effect of familial background on siblings' outcomes over the years. To do so, we split our sample into three groups, depending on the average parental birth cohort: before 1925, between 1925 and 1935, and after 1935, and estimate different sibling correlations for these different groups. We also test the same strategy based on average siblings' birth cohort: before 1954, between 1954 and 1964, and after 1964. Furthermore some familial characteristics are taken into account, in order to investigate their effect on sibling correlations: age difference between ego and alter and whether one of them is firstborn, number of siblings, education and profession of both parents.

Correlations on predicted variables

In this paper, we do not estimate correlations on directly observed variables. Instead we first predict continuous variables to then use them to investigate sibling correlations. And we can model the latent outcome y as the sum of our predicted variable $\bar{y}$ and an ϵ, for each sibling:

$$y_j = \bar{y}_j + \epsilon_j, \text{ with } j = e \text{ for ego, } j = a \text{ for alter.}$$

Considering that the distributions are the same for both siblings (that is $\sigma_{\bar{y}_e} = \sigma_{\bar{y}_a}$ and $\sigma_{\epsilon_e} = \sigma_{\epsilon_a}$) and that $\bar{y}$ and ϵ are independant (so $\sigma_y^2 = \sigma_{\bar{y}}^2 + \sigma_\epsilon^2$), we can find:

$$\rho(y_e, y_a) = \frac{cov(\bar{y}_e,\bar{y}_a)+cov(\epsilon_e,\epsilon_a)}{\sigma_{\bar{y}}^2+\sigma_\epsilon^2} = \frac{\rho(\bar{y}_e,\bar{y}_a).\sigma_{\bar{y}}^2+\rho(\epsilon_e,\epsilon_a).\sigma_\epsilon^2}{\sigma_{\bar{y}}^2+\sigma_\epsilon^2},$$

which means:

$$\rho(y_e, y_a) = \rho(\bar{y}_e, \bar{y}_a) \iff \rho(\bar{y}_e, \bar{y}_a) = \rho(\epsilon_e, \epsilon_a).$$

So if we assume that the sibling association in terms of observable characteristics is the same as the one concerning non observable characteristics, there is no impact of the use of predicted variable instead of observed ones, on the estimated sibling correlations.

Inference

Pearson's correlation coefficient is approximatively normaly distributed for small absolute values of correlation. However for higher values the distribution is skewed. That is why for inference issues we use the so-called Fisher's z transformation to convert Pearson's ρ to the normally distributed variable z, with the standard error σ_z (and number of observations n):

$$z = \frac{1}{2} ln \frac{1+\rho}{1-\rho},$$
$$\sigma_z = \frac{1}{\sqrt{n-3}}.$$

And in order to test whether correlation coefficients from two independant groups 1 and 2 are statistically different:

$$H_0 : \rho_1 = \rho_2$$
$$H_1 : \rho_1 \neq \rho_2,$$

we compute the test statistic U, following the standard normal distribution under the null hypothesis:

$$U = \frac{z_1 - z_2}{\sqrt{\frac{1}{n_1-3} + \frac{1}{n_2-3}}}.$$

5 Results

Polychoric correlations for education and occupation are reported in Table 7 and amounts respectively 0.559 and 0.376 for the entire sample. By gender, it appears again that the association is stronger among same-sex siblings than in mixed pairs.

Table 7: Sibling polychoric correlations - by gender

	All	Brothers	Sisters	Mixed pairs
Education	**0.559**	0.552	0.612	0.529
Occupation	**0.376**	0.446	0.406	0.369

Estimates of sibling linear correlations free of gender and age effects (referred to as "net") are reported in Table 8, and in Table 16 in appendix for results obtained from different methods of construction of each outcome variable, by gender. First of all, the different strategies used here to predict education years, prestige scores and annual earnings for both siblings lead to very similar results, for each of the three outcomes.

Net sibling correlations for prestige scores range from 0.307 to 0.387. For education years they are spread from 0.497 to 0.557. And for annual earnings they range from 0.426 to 0.516. These results are satisfactory because it was expected for sibling correlations to be higher in terms of education than profession. Moreover annual earnings are here predicted based on both education and profession information, therefore it is also not surprising for sibling correlations in terms of earnings to lie in between.

Whereas controlling for gender and age effects does not affect much sibling correlations in terms of profession, it decreases estimates for education. Indeed considering the entire sample, correlations for prestige scores stay stable from 0.330 to 0.337 (with no difference either by gender). They drop from 0.583 to 0.524 for education years when freed from gender and age effects (as well as the results by gender).

For earnings it seems to be the other way around, with estimates increasing from 0.410 to 0.457 with women's earnings predicted using OLS regression, and from 0.415 to 0.458 with the use of Heckman model. However the differences between "gross" and "net" correlations is smaller, when observing siblings pairs by gender.

We find as in Section II that mixed pairs have less in common than same-sex siblings for each outcome. Sisters' scores and education seem to be more correlated than brothers' ones. And brothers again appear to share more in terms of annual earnings than sisters.

Table 8: Sibling correlations - by gender

	Education			**Prestige score**			**Earnings**		
	gross	net	*obs.*	gross	net	*obs.*	gross	net	*obs.*
All	0.583	**0.524**	*21 556*	0.330	**0.337**	*19 673*	0.415	**0.458**	*16 338*
Brothers	0.582	0.539	*5 157*	0.356	0.355	*4 936*	0.518	0.516	*3 896*
Sisters	0.629	0.557	*5 434*	0.378	0.378	*4 743*	0.478	0.469	*4 234*
Mixed pairs	0.557	0.501	*10 965*	0.308	0.307	*9 994*	0.427	0.427	*8 208*
p-values testing the equality of correlation coefficients									
Brothers/Sisters	0.000	0.201		0.201	0.181		0.016	0.004	
Brothers/Mixed	0.026	0.002		0.002	0.002		0.000	0.000	
Sisters/Mixed	0.000	0.000		0.000	0.000		0.001	0.006	

We then also take into account additional parameters, in order to investigate their impact on sibling correlations. We thus use parental and siblings' birth cohort for the study of the evolution of sibling correlations through time. We also use the age difference between ego and alter, the number of siblings and whether or not ego or alter is the oldest child of the family, to measure the effect of some familial characteristics. Sibling correlations obtained investigating these factors are reported in Table 9 and 10.

Concerning the evolution in time of sibling correlations in education, profession and earnings, no clear pattern seems to be observed, when using parental or siblings' average cohort.

As expected, age difference has an impact on sibling correlations: siblings seem to be more alike when they are about the same age. Concerning the effect of family size, correlations slightly increase with the number of siblings, for education and earnings. Lastly sibling correlations seem higher when neither ego nor alter is the oldest child of the family, in terms of earnings and education.

Finally, we want to observe the effect of parental characteristics, such as educational level and socio-professional category. We first want to investigate the average advantage received by children based on these characteristics. We thus construct the average prestige score, educational years and earning level (actually average residuals, free of gender and age effects) of ego, for all possible education levels and socio-professional categories of each parent. This is reported in Figures 11 and 12, in appendix, respectively illustrating the impact of parental education level and socio-professional category (with variables similar to the ordinal ones used for polychoric correlations). On both Figures, the first line represents the effect of fathers'

Table 9: Sibling correlations - evolution in time

	Education		**Prestige score**		**Earnings**	
All	**0.524**	*21 556*	**0.337**	*19 673*	**0.458**	*16 338*
by parental birth cohort						
Before 1925	0.538	*6 763*	0.342	*6 217*	0.475	*4 870*
1925-1935	0.512	*7 016*	0.347	*6 474*	0.457	*5 352*
After 1935	0.519	*7 777*	0.322	*6 982*	0.444	*6 116*
p-values testing the equality of correlation coefficients						
Before 1925/1925-1935	0.032		0.750		0.229	
1925-1935/After 1935	0.536		0.093		0.401	
Before 1925/After 1935	0.113		0.182		0.040	
by siblings' birth cohort						
Before 1954	0.526	*7 012*	0.323	*6 423*	0.462	*4 991*
1954-1964	0.516	*7 613*	0.352	*7 043*	0.455	*5 862*
After 1964	0.530	*6 931*	0.334	*6 207*	0.459	*5 485*
p-values testing the equality of correlation coefficients						
Before 1954/1954-1964	0.379		0.052		0.642	
1954-1964/After 1964	0.242		0.218		0.794	
Before 1954/After 1964	0.773		0.498		0.836	

Note: Number of observations in italics

Table 10: Sibling correlations - effect of family characteristics

	Education		**Prestige score**		**Earnings**	
All	**0.524**	*21 556*	**0.337**	*19 673*	**0.458**	*16 338*
by age difference						
0 to 3 years	0.545	*10 095*	0.348	*9 291*	0.479	*7 717*
4 to 6 years	0.526	*6 910*	0.335	*6 369*	0.450	*5 306*
7 to 10 years	0.471	*4 551*	0.312	*4 013*	0.422	*3 315*
p-values testing the equality of correlation coefficients						
0 to 3/4 to 6	0.088		0.362		0.040	
4 to 6/7 to 10	0.000		0.199		0.115	
0 to 3/7 to 10	0.000		0.031		0.001	
by number of siblings						
2	0.473	*5 891*	0.310	*5 505*	0.407	*4 605*
3	0.497	*5 646*	0.315	*5 199*	0.434	*4 357*
4	0.511	*3 552*	0.305	*3 263*	0.437	*2 715*
5 or more	0.523	*6 467*	0.314	*5 706*	0.440	*4 661*
p-values testing the equality of correlation coefficients						
2/3	0.098		0.748		0.124	
3/4	0.366		0.611		0.893	
4/5 or more	0.414		0.649		0.881	
2/4	0.018		0.816		0.139	
3/5 or more	0.045		0.943		0.744	
2/5 or more	0.000		0.797		0.058	
whether one is the oldest child						
yes	0.498	*13 095*	0.332	*12 070*	0.440	*10 069*
no	0.540	*8 461*	0.316	*7 603*	0.455	*6 269*
p-values testing the equality of correlation coefficients						
yes/no	0.000		0.221		0.269	

Note: Number of observations in italics

characteristic, whereas the second one is for mothers' one. First column depicts ego's score, second column education and third one earnings.

As expected, we can observe a clear positive impact of father's and mother's education on all children's outcomes, as education years, prestige score and earnings increase with the educational level of parents (smaller numbers for higher degrees). Also socio-professional categories of parents have a positive effect on children's outcomes. Indeed all three are higher when fathers are in the group *executive, manager, intellectual worker* and to a lesser extent *intermediate occupations*. Concerning mothers, both these groups yield high outcomes for children. For both parents, the professions *farmer and laborer* lead to lower children's educational, professional and earning levels.

We also want to investigate the potential effect of these parental characteristics on sibling correlations. In Table 11 and 12 can thus be found the correlations in terms of education years, prestige score and annual earnings obtained for each educational level and socio-professional category of both parents. We also estimate these sibling correlations for the whole population, based on residuals net not only from age and gender effects, but also from education and socio-professional categories of the parents.

We can observe a clear decrease of sibling correlations in terms of earnings, with the educational level of both parents. Concerning the effect of parental socio-professional categories, sibling correlations often seem to be lower when parents' profession is *executive, manager, intellectual worker*. No other clear pattern is observable.

6 Conclusion

This paper investigates intergenerational mobility in France through sibling correlations, using data from the French Education-Training-Employment (FQP) survey. We study the impact of familial background on different socio-economic outcomes of adult children.

We first predict continuous outcomes for two siblings in each family: number of education years, prestige scores associated with the profession and annual earnings. We then compute sibling correlations free of gender and age effect. In the main analysis, we find estimated correlations of 0.524 for education, 0.337 for prestige score and 0.458 for annual earnings. These results are in line with the recent literature on sibling correlations. In terms of education, results are indeed a bit higher than 0.4 for Nordic countries - known to present a high mobility - and 0.6 for the United States - at the other end of the scale. It is therefore not surprising for our results to lie inbetween, and to be close to German ones, as we can see

Table 11: Sibling correlations - effect of parental education

	Education		**Prestige score**		**Earnings**	
All	**0.524**	*21 556*	**0.337**	*19 673*	**0.458**	*16 338*
net also from parental charac.	0.349	*13 736*	0.200	*12 847*	0.294	*10 624*
Father						
diplome suprieur	0.312	*1 284*	0.180	*1 181*	0.243	*1 037*
bac+2	0.439	*482*	0.236	*456*	0.289	*421*
bac/brevet pro	0.334	*1 144*	0.259	*1 062*	0.288	*921*
CAP, BEP	0.395	*3 290*	0.224	*3 062*	0.314	*2 636*
BEPC	0.375	*742*	0.201	*682*	0.355	*600*
Aucun ou CEP	0.452	*13 978*	0.283	*12 703*	0.405	*10 272*
Mother						
diplome suprieur	0.280	*475*	0.231	*430*	0.268	*387*
bac+2	0.426	*729*	0.231	*686*	0.296	*617*
bac/brevet pro	0.334	*969*	0.190	*894*	0.285	*774*
CAP, BEP	0.393	*1 955*	0.241	*1 839*	0.328	*1 614*
BEPC	0.385	*1 118*	0.256	*1 038*	0.340	*897*
Aucun ou CEP	0.455	*16 162*	0.282	*14 668*	0.399	*11 947*

Note: Number of observations in italics

Table 12: Sibling correlations - effect of parental profession

	Education		**Prestige score**		**Earnings**	
All	**0.524**	*21 556*	**0.337**	*19 673*	**0.458**	*16 338*
net also from parental charac.	0.349	*13 736*	0.200	*12 847*	0.294	*10 624*
Father						
farmer	0.435	*2 553*	0.217	*2 368*	0.383	*1 362*
skilled workman, ...	0.455	*2 625*	0.257	*2 381*	0.386	*1 742*
executive, ...	0.370	*1 846*	0.209	*1 686*	0.306	*1 516*
intermediate occupations	0.451	*2 829*	0.266	*2 655*	0.335	*2 402*
administrative, ...	0.444	*2 277*	0.277	*2 089*	0.383	*1 886*
laborer	0.419	*8 694*	0.256	*7 881*	0.364	*6 905*
Mother						
farmer	0.411	*1 974*	0.216	*1 876*	0.368	*1 076*
skilled workman, ...	0.420	*1 326*	0.226	*1 220*	0.380	*887*
executive, ...	0.375	*292*	0.230	*260*	0.231	*231*
intermediate occupations	0.446	*1 723*	0.245	*1 606*	0.348	*1 442*
administrative, ...	0.451	*5 877*	0.286	*5 471*	0.387	*4 897*
laborer	0.456	*3 038*	0.275	*2 849*	0.387	*2 469*

Note: Number of observations in italics

concerning earnings. For Germany, sibling correlations in terms of income amount around 0.4 as ours, slightly lower than American ones and higher than the results around 0.2 for Nordic countries.

We also want to measure the effect of some personal and familial characteristics on these sibling correlations. The mosts significant result is for same-sex sibling pairs to share more similarities than mixed pairs. We find that family composition as also an impact, sibling correlations for instance increasing with the number of siblings in the family. Finally parental education and socio-professional levels tend to decrease sibling correlations. Presenting sibling correlations for different socio-economic outcomes, as well as the impact some familial characteristics can have on them, this paper constitutes a first step to fill the gap in the literature on sibling correlations in France.

A Sibling correlations in the literature

Table 13: Estimates of sibling correlations in education and income

Country	Authors	Data source	Cohorts/ages	Estimate (std err)
Education				
Norway	Björklund and Salvanes (2010)	registers	1962-68	0.40 (0.01)
Sweden	Björklund et al. (2009)	registers	1962-68/30-38	0.48 (0.02)
	Björklund and Jäntti (2012)	registers	1951-67/≈40	0.44 (0.00)
United States	Conley and Glauber (2008)	PSID	1958-76/25-43	0.63 (0.07)
	Mazumder (2008)	NLSY	1957-64/26-41	0.62 (0.01)
	Mazumder (2011)	PSID	1951-68	0.67 (0.03)
Income				
Denmark	Björklund et al. (2002)	registers	1951-68/25-42	0.23 (0.01)
	Schnitzlein (2011)	registers	1952-76/30-50	0.20 (0.01)
Finland	Björklund et al. (2002)	registers	1953-65/25-42	0.26 (0.03)
Germany	Schnitzlein (2011)	SOEP	1952-78/30-50	0.43 (0.08)
Norway	Björklund et al. (2002)	registers	1950-70/25-42	0.14 (0.01)
Sweden	Björklund et al. (2002)	registers	1948-65/25-42	0.25 (0.01)
	Björklund et al. (2009)	registers	1962-68/30-38	0.37 (0.00)
	Björklund and Jäntti (2012)	registers	1951-67/31-40	0.22 (0.00)
United States	Björklund et al. (2002)	PSID	1951-67/25-42	0.43 (0.04)
	Conley and Glauber (2008)	PSID	1958-76/25-43	0.34 (0.07)
	Mazumder (2008)	NLSY	1957-65/26-41	0.49 (0.02)
	Mazumder (2011)	PSID	1951-68	0.51 (0.04)
	Mazumder and Levine (2004)	NLSY	1957-65/26-38	0.45 (0.05)
	Schnitzlein (2011)	PSID	1949-77/30-50	0.45 (0.04)

B Prediction of the outcomes

B.1 Prestige scores

Table 14: Prestige score - 15 groups

	ego		alter	
Score	Freq.	Percent	Freq.	Percent
-0.8	1844	8.61	1969	9.82
-0.68	2387	11.15	1868	9.31
-0.34	2514	11.74	2133	10.63
-0.32	3211	15.00	3339	16.64
-0.29	580	2.71	574	2.86
-0.07	1732	8.09	2138	10.66
-0.03	544	2.54	702	3.50
0	1464	6.84	1228	6.12
0.07	485	2.27	668	3.33
0.31	1481	6.92	1051	5.24
0.41	2103	9.82	2228	11.11
0.54	96	0.45	143	0.71
0.57	1136	5.31	752	3.75
072	1625	7.59	995	4.96
1.03	204	0.95	273	1.36
Total	21406	100.00	20061	100.00

Table 15: Prestige score - 30 groups

	ego		alter	
Score	Freq.	Percent	Freq.	Percent
-1.694785	566	2.65	163	0.81
-1.563741	1069	5.00	1596	7.96
-1.523125	209	0.98	210	1.05
-1.488498	867	4.05	755	3.77
-1.295346	1520	7.10	1113	5.55
-0.9188861	2182	10.20	1696	8.46
-0.7637425	1072	5.01	1514	7.55
-0.7290986	381	1.78	355	1.77
-0.6152064	332	1.55	437	2.18
-0.5838171	1225	5.73	991	4.94
-0.5739842	533	2.49	479	2.39
-0.3990526	120	0.56	459	2.29
-0.2801967	306	1.43	83	0.41
-0.2024503	154	0.72	32	0.16
-0.1149778	1464	6.84	1228	6.12
-0.0760427	1732	8.09	2138	10.66
0.0658743	544	2.54	702	3.50
0.138291	485	2.27	668	3.33
0.4168512	643	3.01	390	1.95
0.6803553	219	1.02	223	1.11
0.7463204	838	3.92	661	3.30
0.766371	399	1.86	322	1.61
0.8302992	931	4.35	901	4.49
0.8631468	764	3.57	993	4.95
1.028427	96	0.45	143	0.71
1.296386	298	1.39	247	1.23
1.324646	815	3.81	462	2.30
1.369108	810	3.79	533	2.66
1.40581	619	2.89	282	1.41
1.95731	204	0.95	273	1.36
Total	21397	100.00	20049	100.00

B.2 Education years

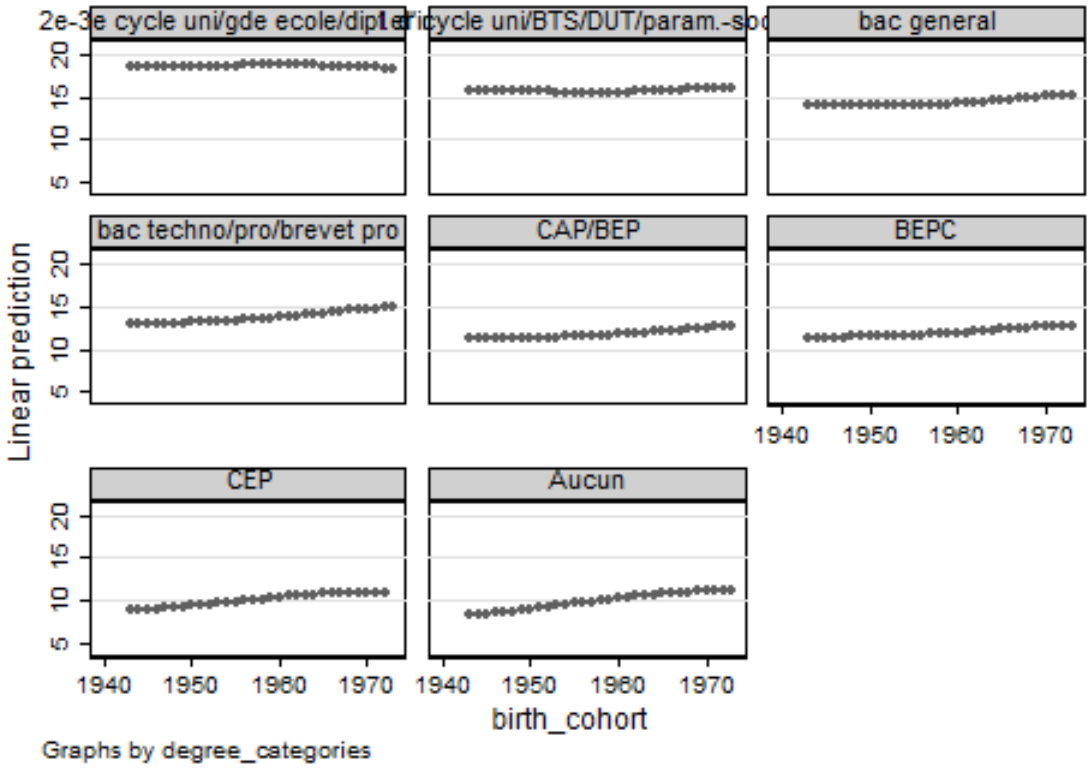


Figure 1: Estimation results: 4th order - men

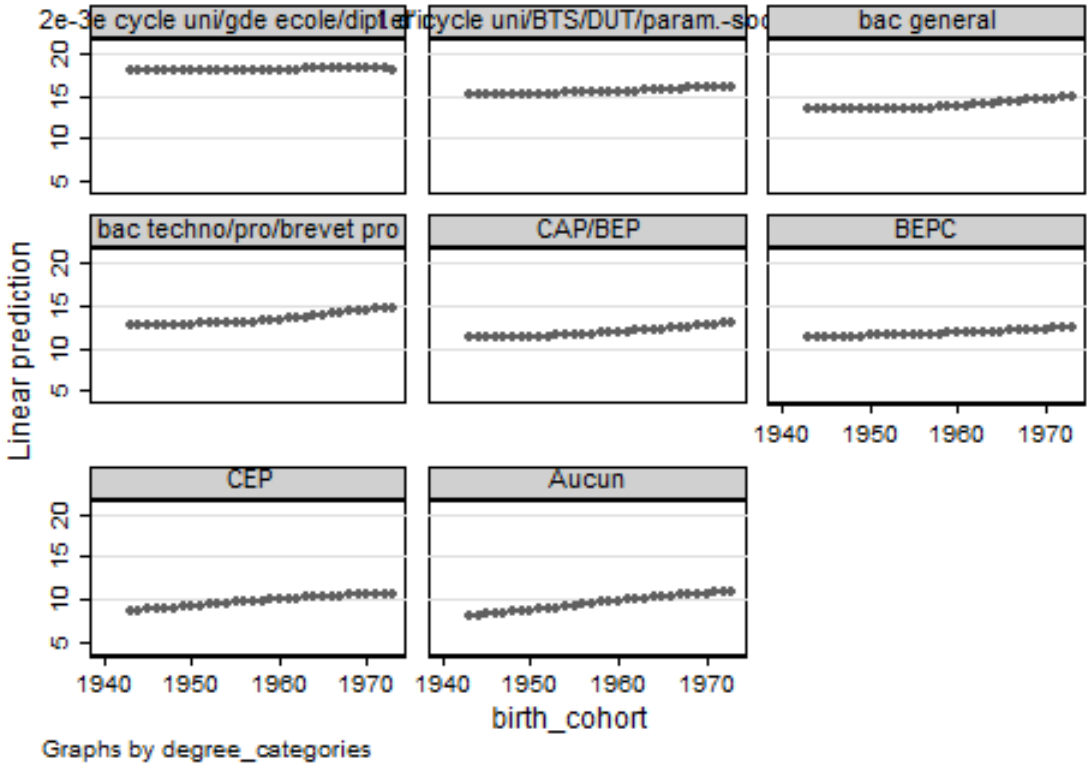


Figure 2: Estimation results: 4th order - women

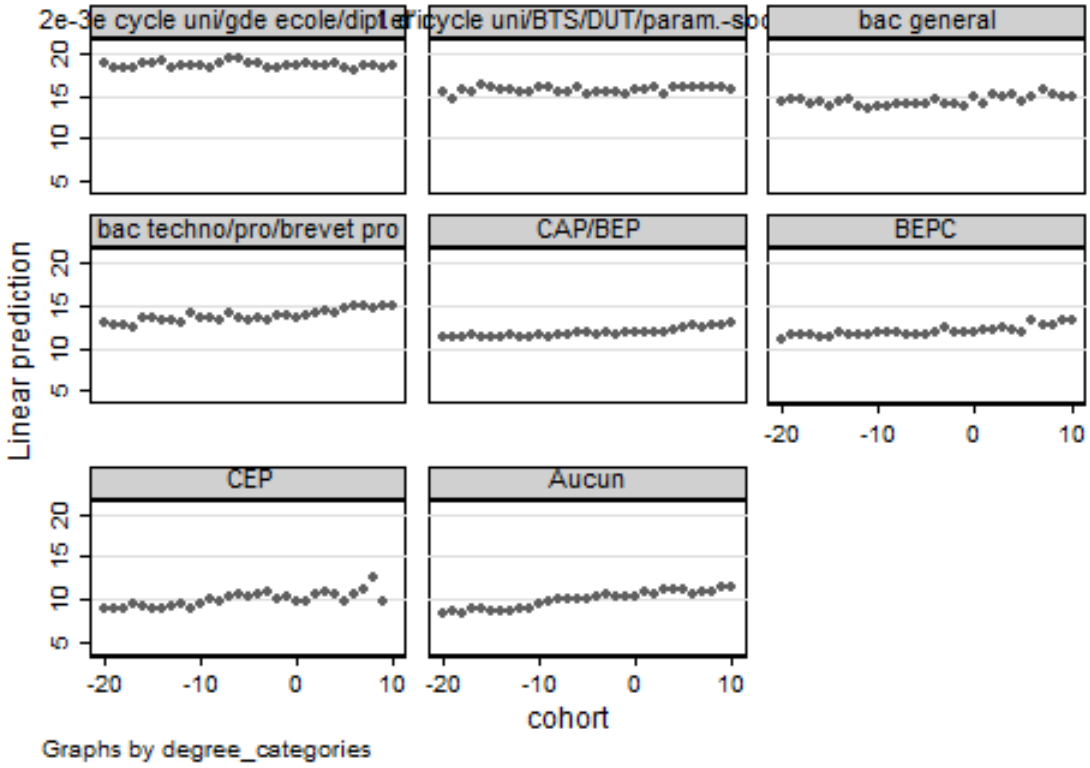


Figure 3: Estimation results: non-parametric specification - men

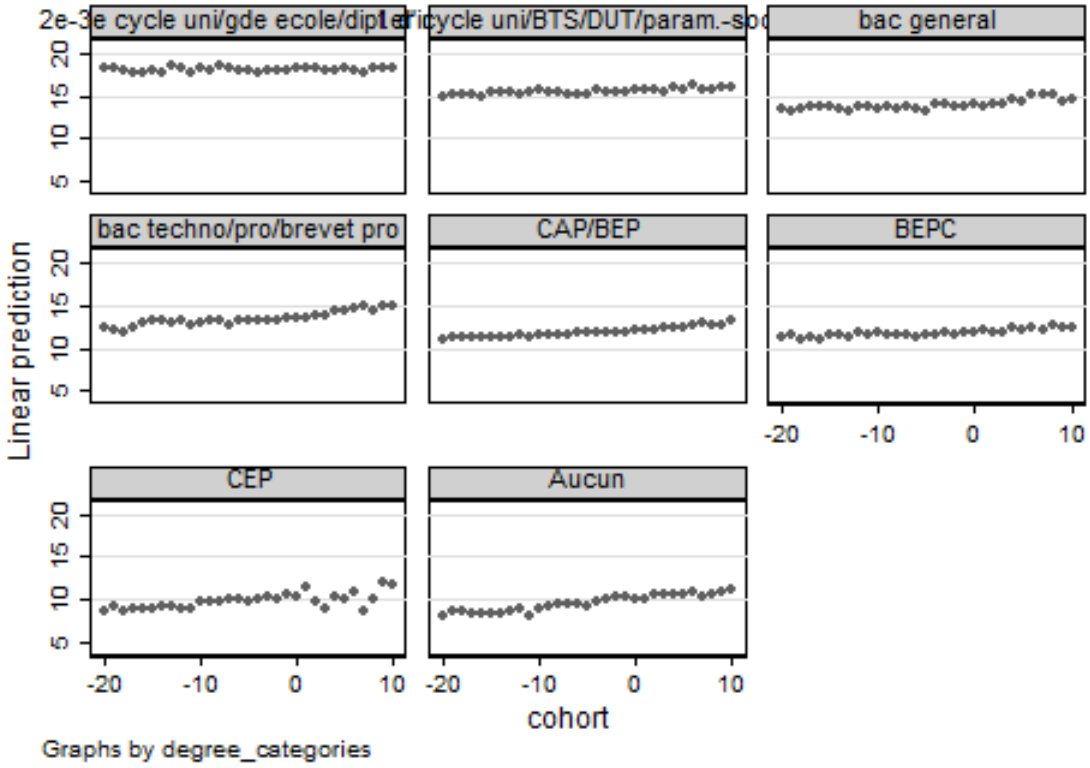


Figure 4: Estimation results: non-parametric specification - women

B.3 Annual earnings

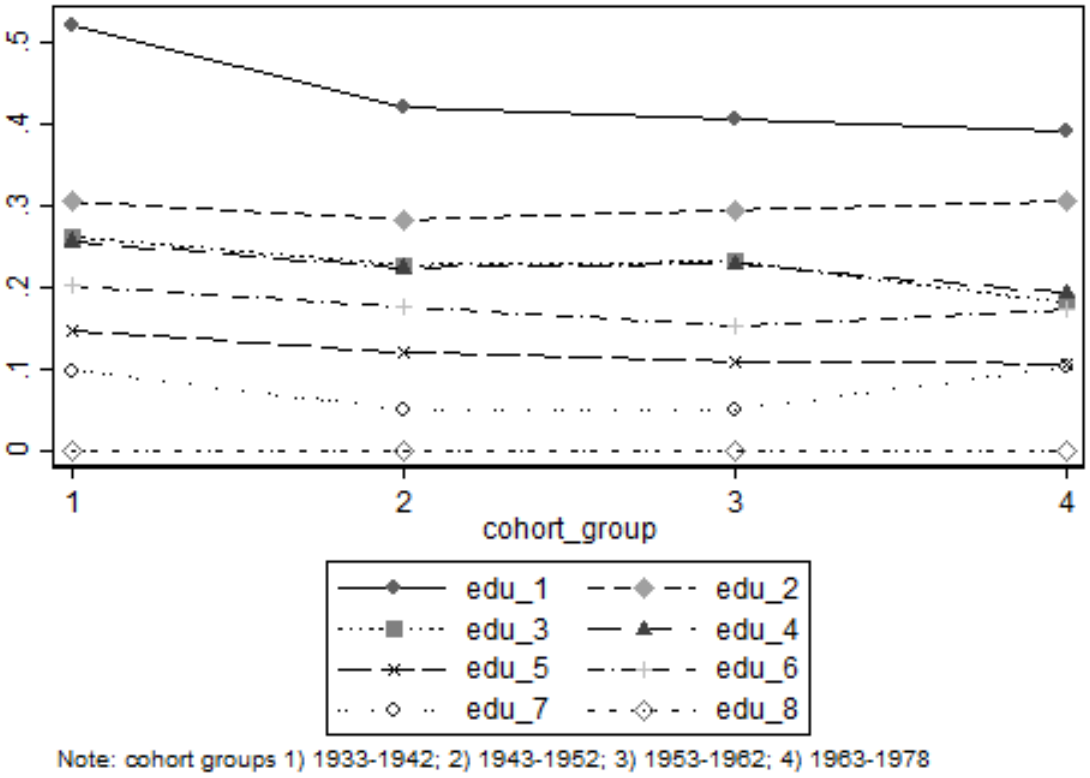


Figure 5: Earnings gains by education and cohort, with "no degree" as reference - men

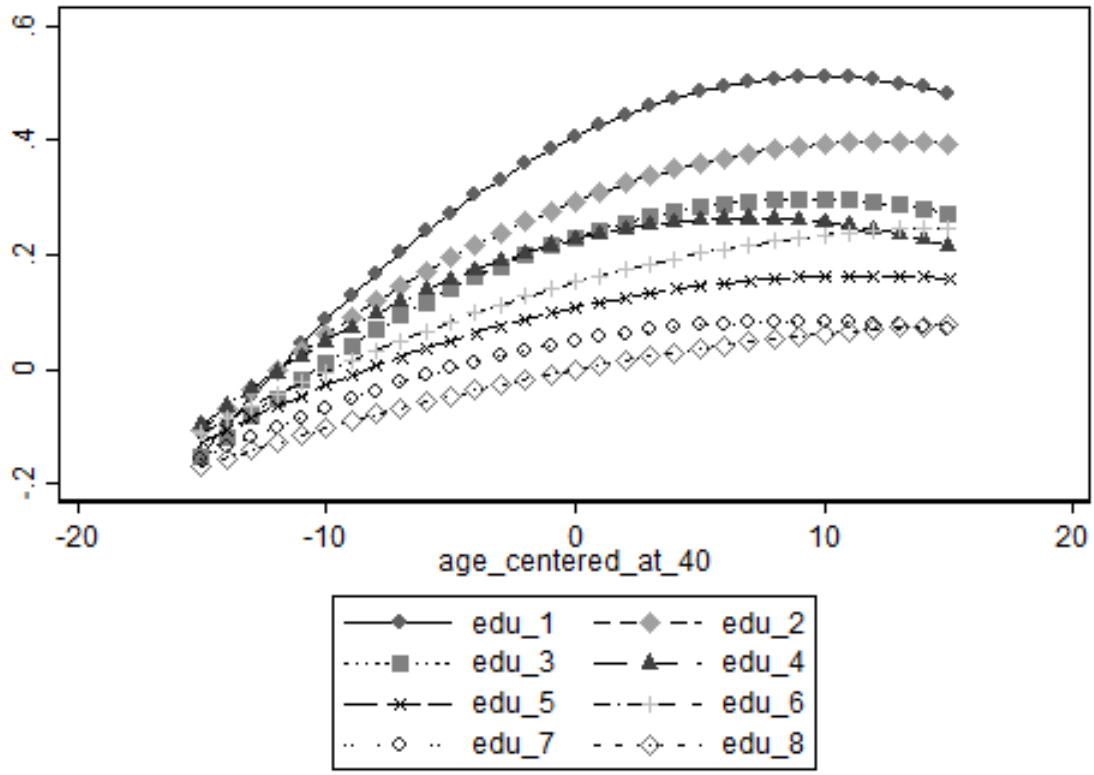
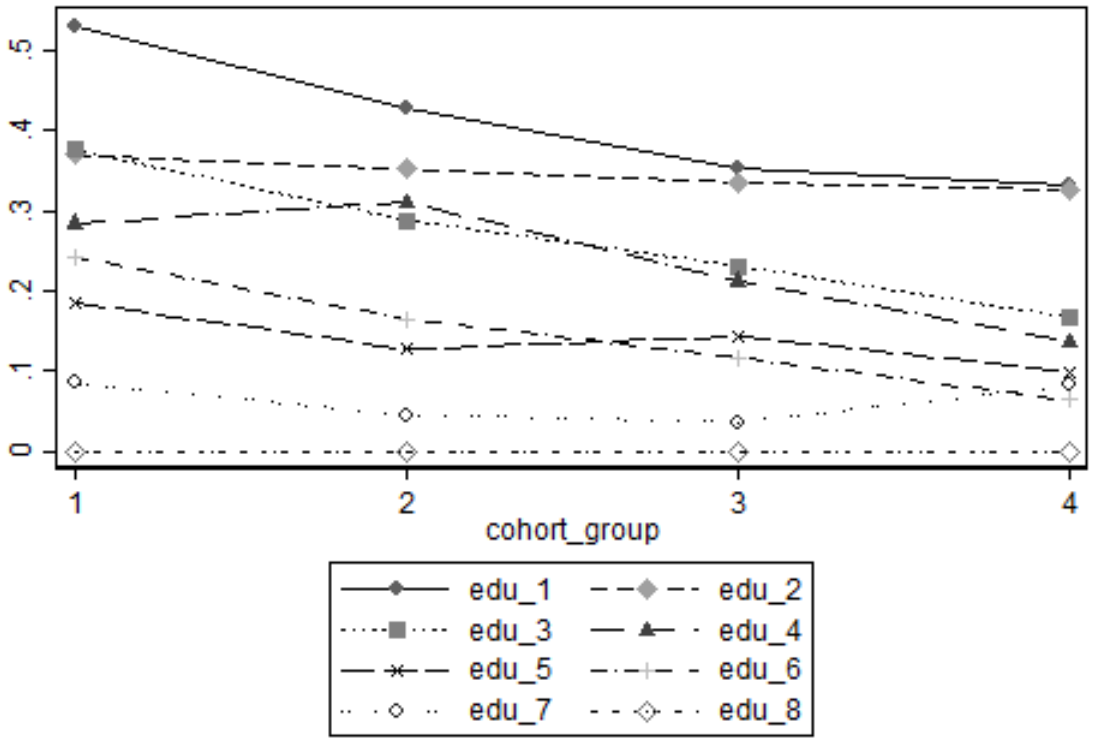


Figure 6: Returns to age by education, for the group reference "born 1953-1962" - men



Note: cohort groups 1) 1933-1942; 2) 1943-1952; 3) 1953-1962; 4) 1963-1978

Figure 7: Earnings gains by education and cohort, with "no degree" as reference - women

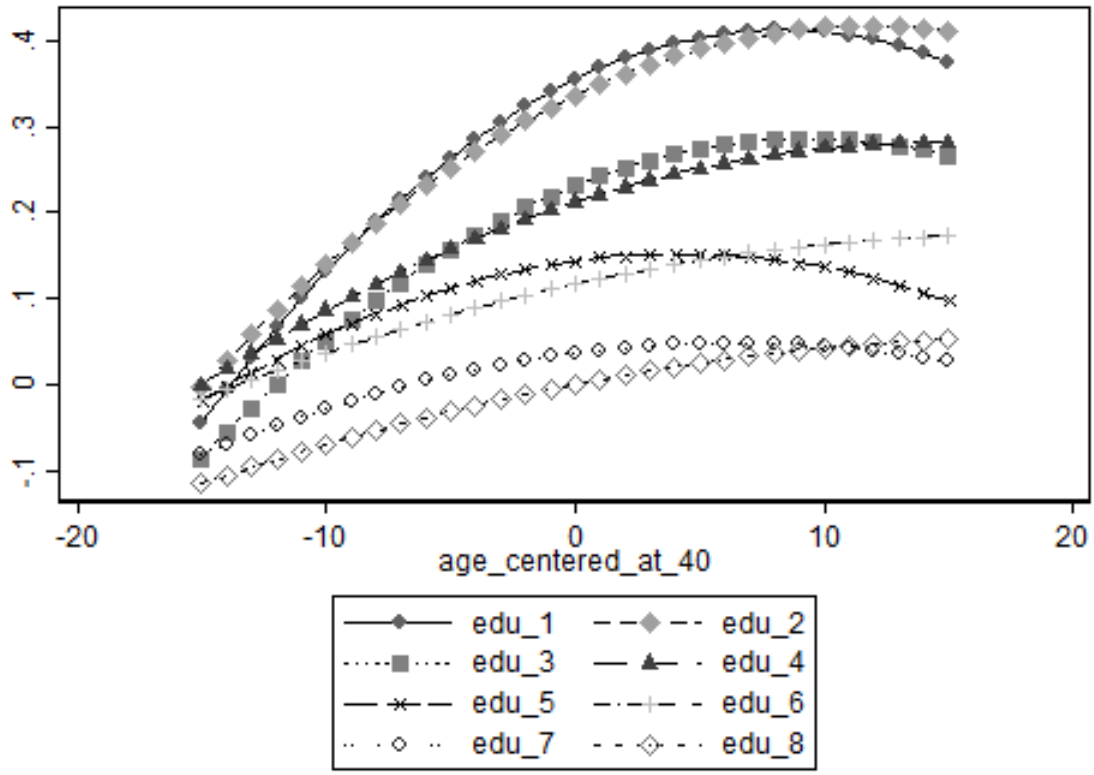


Figure 8: Returns to age by education, for the group reference "born 1953-1962" - women

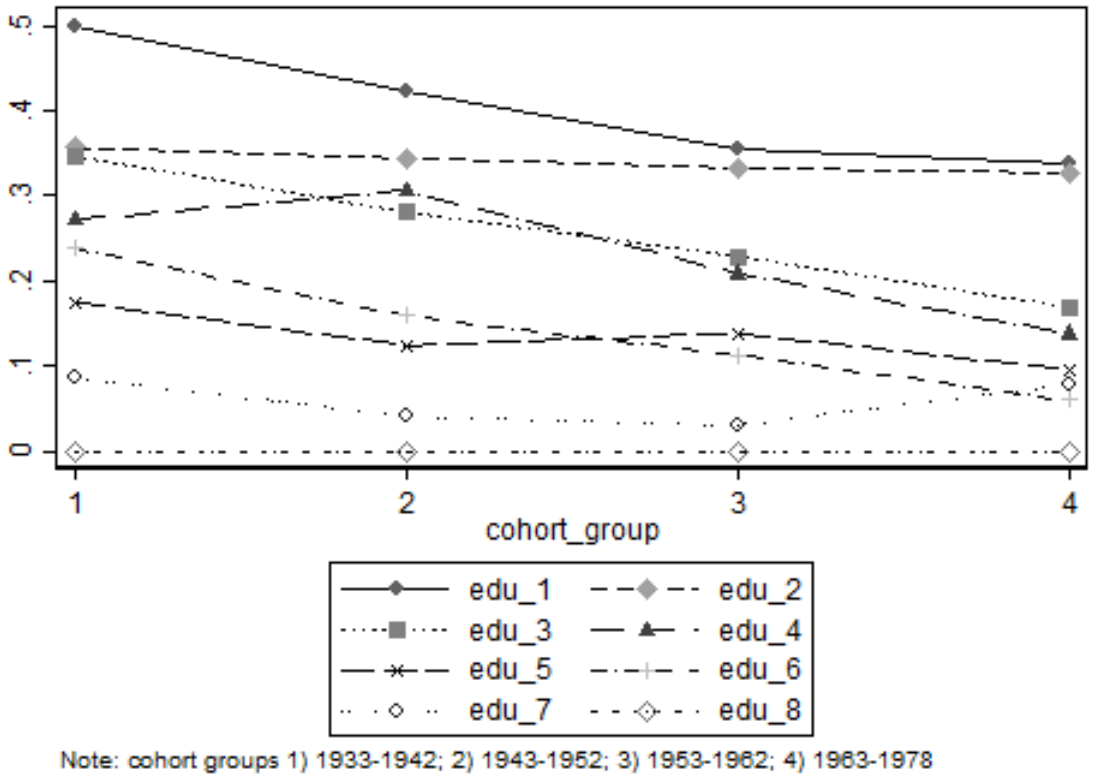


Figure 9: Earnings gains by education and cohort, with "no degree" as reference - women (Heckman model)

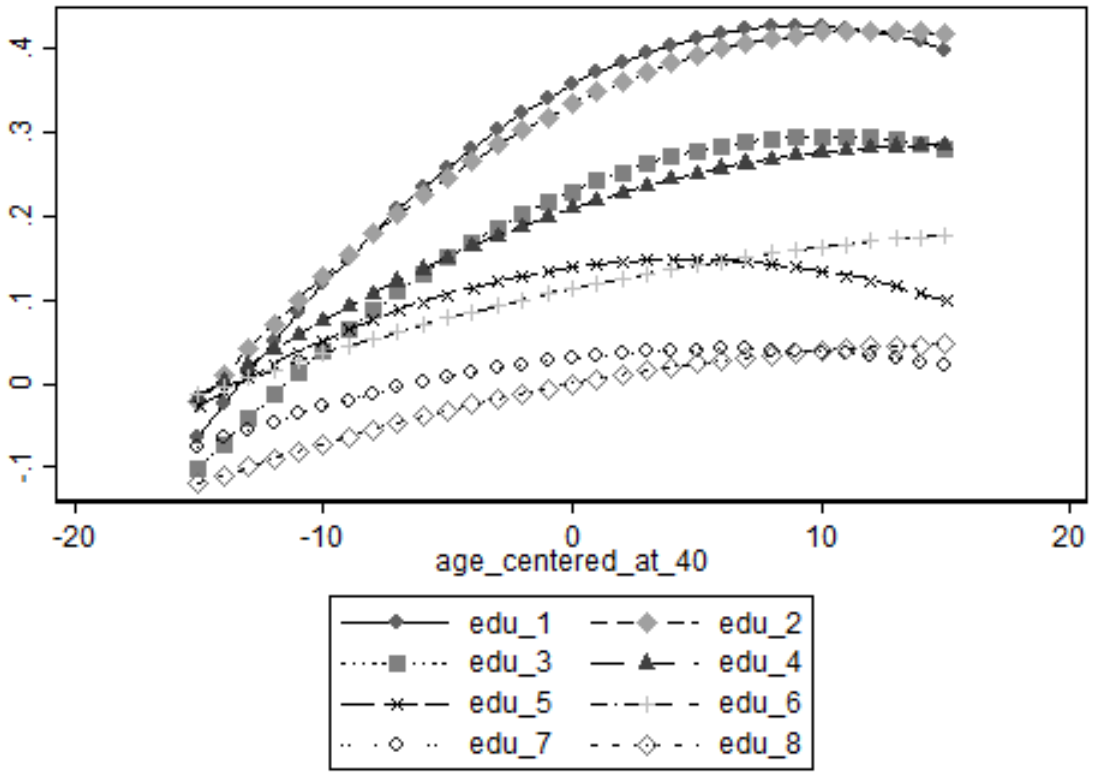


Figure 10: Returns to age by education, for the group reference "born 1953-1962" - women (Heckman model)

C Sibling correlations

C.1 Effect of parental characteristics on children's outcomes

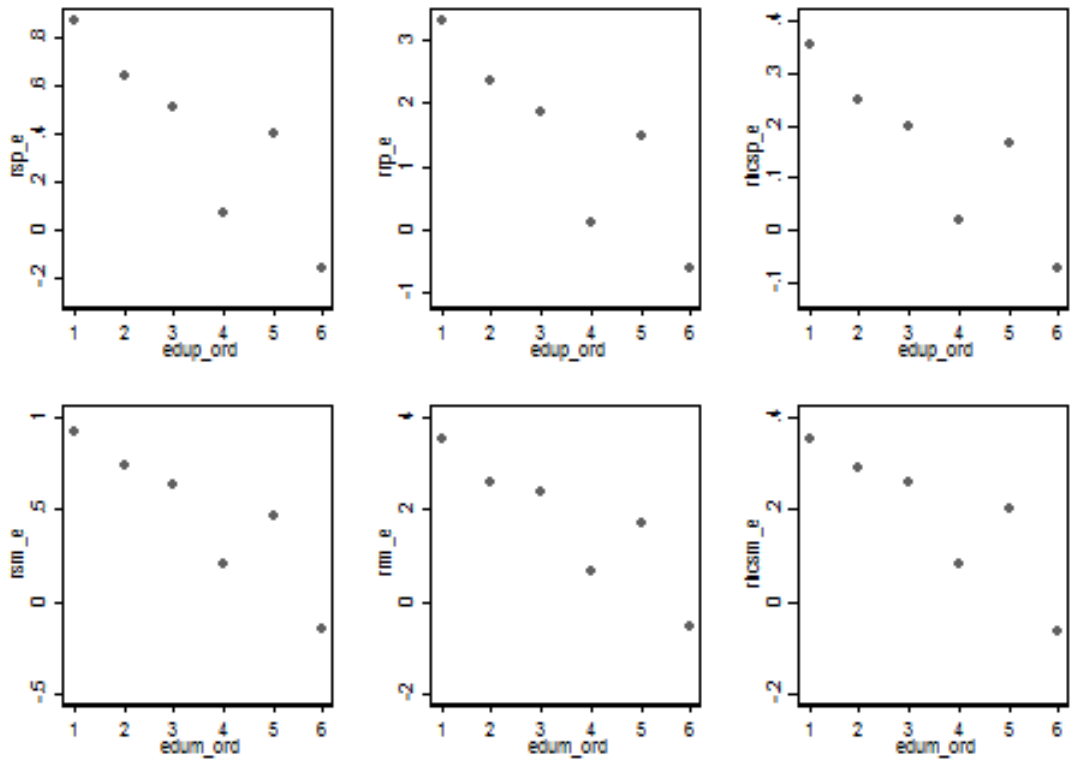


Figure 11: Average advantage from parental education

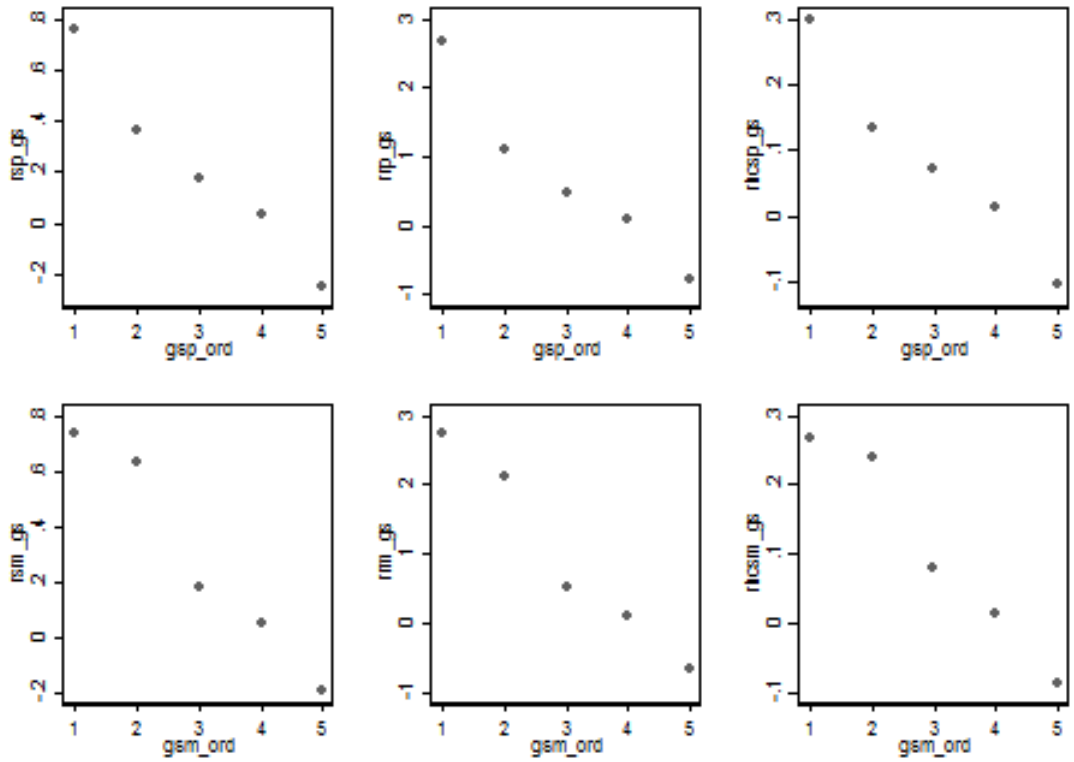


Figure 12: Average advantage from parental profession

C.2 Detailed sibling correlations

Table 16: Sibling correlations - by gender

	Education years					**Prestige score**					**Annual earnings**				
	Non-parametric		4th order OLS			15 groups		30 groups			OLS regression		Annual earnings		
	gross	net	gross	net	*obs.*	gross	net	gross	net	*obs.*	gross	net	gross	net	*obs.*
All	0.578	0.520	0.583	**0.524**	*21 556*	0.335	0.342	0.330	**0.337**	*19 673*	0.410	0.457	0.415	**0.458**	*16 338*
Brothers	0.575	0.534	0.582	0.539	*5 157*	0.358	0.358	0.356	0.355	*4 936*	0.518	0.516	0.518	0.516	*3 896*
Sisters	0.626	0.555	0.629	0.557	*5 434*	0.387	0.387	0.378	0.378	*4 743*	0.475	0.467	0.478	0.469	*4 234*
Mixed pairs	0.553	0.497	0.557	0.501	*10 965*	0.311	0.311	0.308	0.307	*9 994*	0.426	0.426	0.427	0.427	*8 208*
p-values testing the equality of correlation coefficients															
Brothers/Sisters	0.000	0.120	0.000	0.201		0.097	0.096	0.201	0.181		0.010	0.003	0.016	0.004	
Brothers/Mixed	0.047	0.003	0.026	0.002		0.002	0.002	0.002	0.002		0.000	0.000	0.000	0.000	
Sisters/Mixed	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000		0.001	0.007	0.001	0.006	

Note: Number of observations for prestige scores correspond to the classification with 30 groups, the one counting only 15 groups yielding slightly higher numbers.

Table 17: Sibling correlations - effect of father's education

	Education		**Prestige score**		**Earnings**	
All	**0.524**	*21 556*	**0.337**	*19 673*	**0.458**	*16 338*
1) diplome suprieur	0.312	*1 284*	0.180	*1 181*	0.243	*1 037*
2) bac+2	0.439	*482*	0.236	*456*	0.289	*421*
3) bac/brevet pro	0.334	*1 144*	0.259	*1 062*	0.288	*921*
4) CAP, BEP	0.395	*3 290*	0.224	*3 062*	0.314	*2 636*
5) BEPC	0.375	*742*	0.201	*682*	0.355	*600*
6) Aucun ou CEP	0.452	*13 978*	0.283	*12 703*	0.405	*10 272*
p-values testing the equality of correlation coefficients						
1/2	0.006		0.289		0.390	
2/3	0.023		0.659		0.982	
3/4	0.042		0.292		0.453	
4/5	0.563		0.577		0.306	
5/6	0.013		0.027		0.170	
1/3	0.555		0.049		0.285	
2/4	0.269		0.799		0.602	
3/5	0.326		0.213		0.153	
4/6	0.000		0.002		0.000	
1/4	0.004		0.182		0.035	
2/5	0.186		0.547		0.247	
3/6	0.000		0.423		0.000	
1/5	0.128		0.647		0.016	
2/6	0.730		0.292		0.008	
1/6	0.000		0.000		0.000	

Note: Number of observations in italics

Table 18: Sibling correlations - effect of mother's education

	Education		**Prestige score**		**Earnings**	
All	**0.524**	*21 556*	**0.337**	*19 673*	**0.458**	*16 338*
1) diplome suprieur	0.280	*475*	0.231	*430*	0.268	*387*
2) bac+2	0.426	*729*	0.231	*686*	0.296	*617*
3) bac/brevet pro	0.334	*969*	0.190	*894*	0.285	*774*
4) CAP, BEP	0.393	*1 955*	0.241	*1 839*	0.328	*1 614*
5) BEPC	0.385	*1 118*	0.256	*1 038*	0.340	*897*
6) Aucun ou CEP	0.455	*16 162*	0.282	*14 668*	0.399	*11 947*
p-values testing the equality of correlation coefficients						
1/2	0.005		0.997		0.634	
2/3	0.029		0.393		0.818	
3/4	0.086		0.183		0.278	
4/5	0.818		0.685		0.736	
5/6	0.006		0.386		0.049	
1/3	0.286		0.458		0.767	
2/4	0.361		0.807		0.460	
3/5	0.180		0.125		0.210	
4/6	0.002		0.078		0.002	
1/4	0.013		0.842		0.245	
2/5	0.310		0.587		0.349	
3/6	0.000		0.005		0.000	
1/5	0.030		0.645		0.190	
2/6	0.343		0.163		0.005	
1/6	0.000		0.268		0.004	

Note: Number of observations in italics

Table 19: Sibling correlations - effect of father's profession

	Education		**Prestige score**		**Earnings**	
All	**0.524**	*21 556*	**0.337**	*19 673*	**0.458**	*16 338*
1) farmer	0.435	*2 553*	0.217	*2 368*	0.383	*1 362*
2) skilled workman, ...	0.455	*2 625*	0.257	*2 381*	0.386	*1 742*
3) executive, ...	0.370	*1 846*	0.209	*1 686*	0.306	*1 516*
4) intermediate occupations	0.451	*2 829*	0.266	*2 655*	0.335	*2 402*
5) administrative, ...	0.444	*2 277*	0.277	*2 089*	0.383	*1 886*
6) laborer	0.419	*8 694*	0.256	*7 881*	0.364	*6 905*
p-values testing the equality of correlation coefficients						
1/2	0.368		0.145		0.926	
2/3	0.001		0.111		0.010	
3/4	0.001		0.053		0.316	
4/5	0.749		0.689		0.077	
5/6	0.200		0.362		0.407	
1/3	0.011		0.792		0.019	
2/4	0.847		0.736		0.065	
3/5	0.005		0.028		0.011	
4/6	0.070		0.632		0.166	
1/4	0.468		0.067		0.108	
2/5	0.619		0.480		0.914	
3/6	0.023		0.065		0.021	
1/5	0.708		0.034		0.995	
2/6	0.046		0.958		0.348	
1/6	0.389		0.079		0.463	

Note: Number of observations in italics

Table 20: Sibling correlations - effect of mother's profession

	Education		**Prestige score**		**Earnings**	
All	**0.524**	*21 556*	**0.337**	*19 673*	**0.458**	*16 338*
1) farmer	0.411	*1 974*	0.216	*1 876*	0.368	*1 076*
2) skilled workman, ...	0.420	*1 326*	0.226	*1 220*	0.380	*887*
3) executive, ...	0.375	*292*	0.230	*260*	0.231	*231*
4) intermediate occupations	0.446	*1 723*	0.245	*1 606*	0.348	*1 442*
5) administrative, ...	0.451	*5 877*	0.286	*5 471*	0.387	*4 897*
6) laborer	0.456	*3 038*	0.275	*2 849*	0.387	*2 469*
p-values testing the equality of correlation coefficients						
1/2	0.748		0.759		0.753	
2/3	0.407		0.960		0.026	
3/4	0.177		0.813		0.072	
4/5	0.822		0.116		0.134	
5/6	0.764		0.596		0.987	
1/3	0.501		0.825		0.039	
2/4	0.381		0.611		0.389	
3/5	0.127		0.342		0.011	
4/6	0.670		0.299		0.180	
1/4	0.187		0.368		0.577	
2/5	0.209		0.043		0.825	
3/6	0.109		0.458		0.013	
1/5	0.056		0.005		0.506	
2/6	0.173		0.130		0.845	
1/6	0.051		0.034		0.548	

Note: Number of observations in italics

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